BONUS POSTER: CLAMPING SECRETS

ISSUE 173 NOVEMBER 2006

Better Homes and Gardens®

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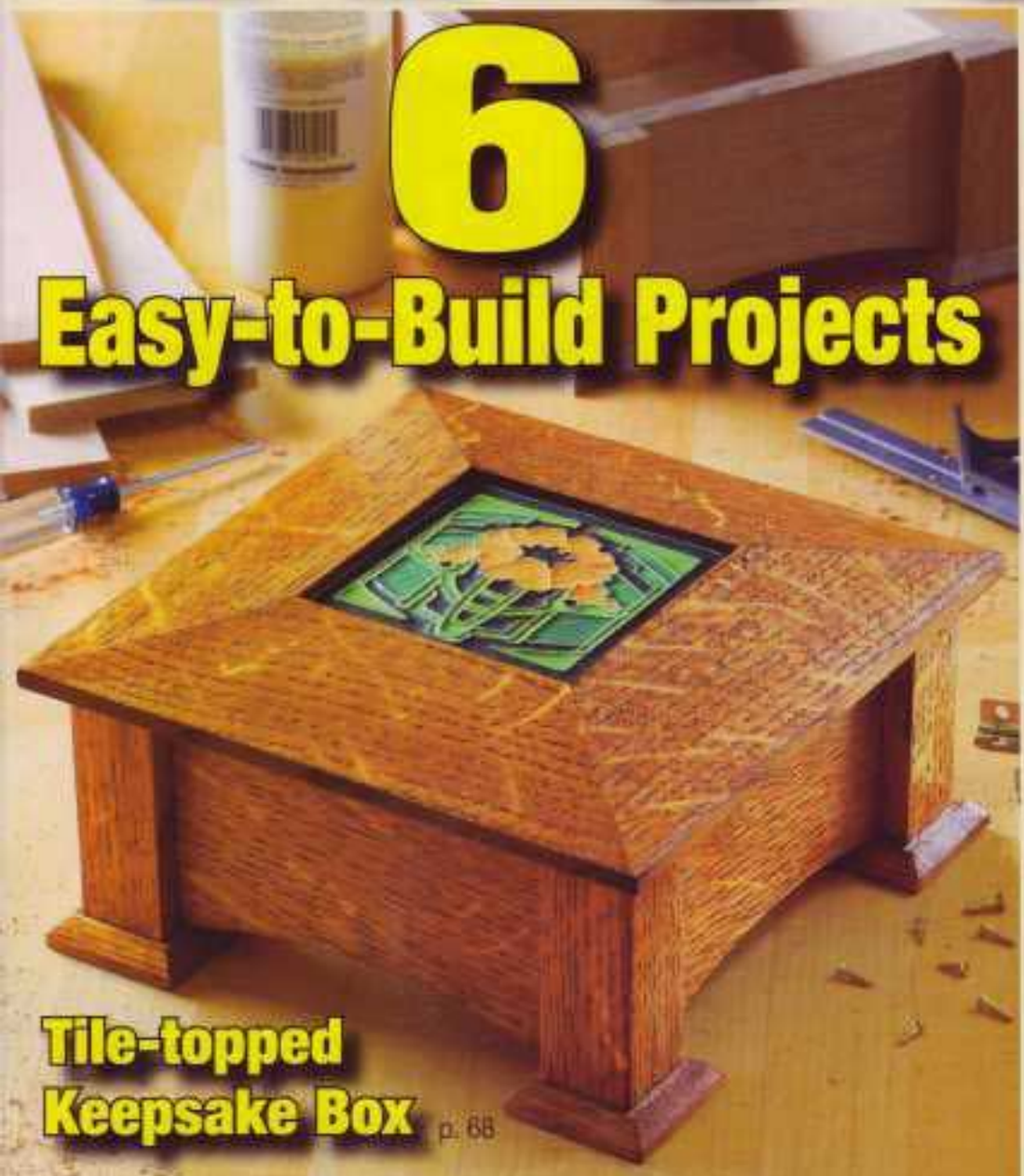

6 Easy-to-Build Projects

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plus

- 3-in-1 Child's Transition Bed
- Magic Wand Kaleidoscope
- Hot Casserole Dish Holder
- Proportioning Gauge
- Custom Sanding Block

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(Look for this icon)

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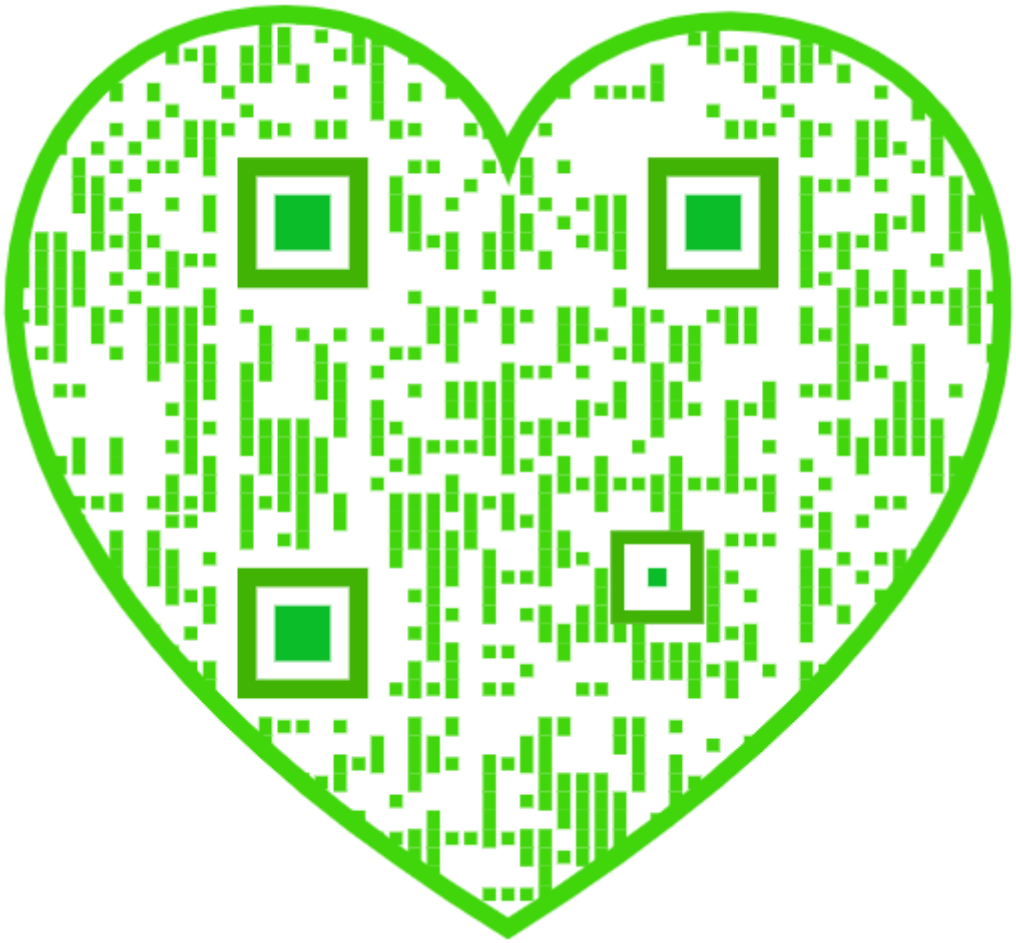

WOOD®

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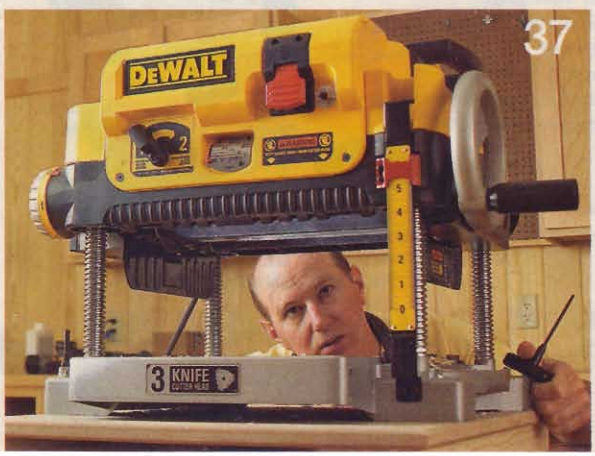

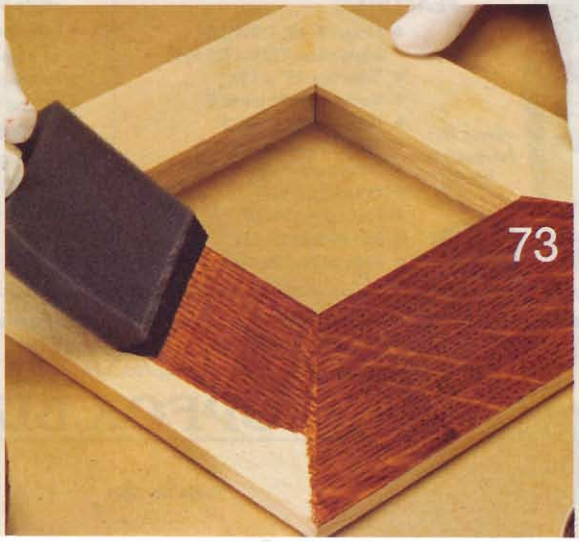

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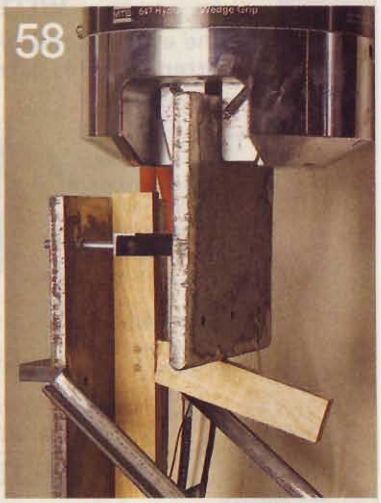

Better Homes and Gardens®
WOOD®

November 2006 | Vol. 23, No. 6 | Issue No. 173

We asked our staff:
What is your favorite wood?

I like the classic warm look and variety of grain patterns found in **red oak**, from straight and dense to cathedral.

Honduran mahogany is easy to work and doesn't require stain.

Mine is **White ash**. It has a striking grain and machines well.

Cherry has a wonderful balance of distinct figure and color. It allows a wide range of finishes.

Walnut cuts and machines well. Also the rich color yields a naturally warm appearance.

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In Memoriam — E.T. Meredith III (1933–2003)

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editor's angle

More help for your buying decisions

As woodworkers we invest a lot of money in tools, wood, and various supplies. Like you, I want to spend those woodworking bucks as wisely as possible. That's why we created a new Web site that's all about making smart woodworking purchases.

WOODWorkersCenter.com

I'm about to discuss how much you spend on your woodworking habit, so you may want to hide this issue before your spouse reads it. My apologies if your significant other got to the mailbox first. If you're unattached, rest easy.

According to a recent study, our average subscriber—that's you—spends $1,500 per year on tools, accessories, and various woodworking supplies. On average, you have about $11,500 invested in your shops. Serious money.

With that kind of dough at stake, we've decided it's time to do more to help guide you in buying the best tools, getting great bargains on wood, and purchasing the supplies (glue, hardware, finishes, etc.) that best fit your requirements.

So, we built WOODWorkersCenter.com, a new site where you can:

- Find summaries of recent *WOOD*® magazine tool reviews.
- Join a tool-buying forum of woodworkers far and wide willing to share their buying experiences and tips with you.
- Search for companies that offer the products you're looking to purchase. For each company you'll find a microsite explaining their products and services.
- Find smart-shopping ideas to leave more moola in your pocket.
- Request catalogs and product information directly from manufacturers. (You can still use the mail-in card in the Free Information Worth Writing For section on *page 104*, but you'll get the materials quicker by requesting them online.)
- Discover links to money-saving offers at the sales sections of various suppliers.

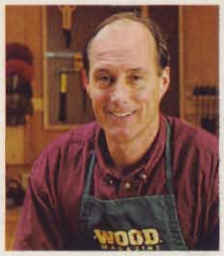
Our goals for this new site are simple. First, we want to arm you with as much information as possible so you buy the best product for your needs at a reasonable price. And, we want to help you save time in arriving at your buying decisions.

About those light bulbs

Woodworkers love shop tips, and we pride ourselves on packing tons of helpful tips into every issue. As we put this issue together we thought it would be fun—for you and us—to locate every single tip, so we placed a light bulb by each one. We hope this brilliant idea helps you easily find and recall these little pearls of woodworking wisdom. If you like or dislike the idea, or have any other thoughts for making *your* woodworking magazine better, contact me at woodmail@woodmagazine.com.

Enjoy your woodworking, be safe, and buy wise!

Bill Krier



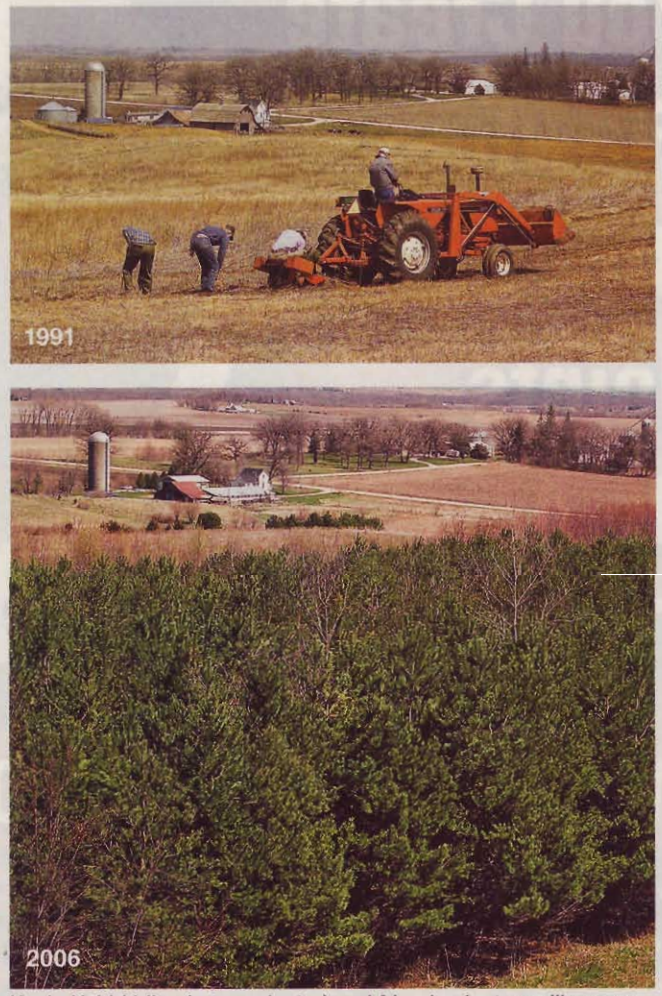
sounding board

Our bulletin board for letters, comments, and timely updates

Trees flourish 15 years later at farm

I was recently looking through old issues of *WOOD®* magazine, and read about Kevin Kyhl, the Parkersburg, Iowa, farmer who was planting trees on his 280-acre farm (issue 42, April 1991). I'm wondering how big those trees are today, and if he's still planting?

—Robert Ellis, Columbia, Ky.



Kevin Kyhl (riding in tree planter) and friends plant seedlings on Kyhl's farm, *top*, in 1991. Today, those seedlings have grown into trees 30–40' tall, as shown *above*, from the same vantage point.

Some of the trees Kevin began planting in 1986, Robert, are just beginning to reach 4–6" in diameter. Although he cuts some of those for thinning purposes, most of the hardwood trees will take 40–50 years to mature, a gift for the next generation. Until then he continues to convert more acres to forest. "There is real satisfaction in seeing the land change from cattle pasture back to forests," Kevin said when we caught up with him.

In the meantime, small nursery trees provide his best cash crop: He sells hardwoods for shade trees and conifers for windbreak plantings. "It's been fun," he said. "You definitely don't make much money doing this. You have to love it." Kevin estimates he's planted 125,000 seedlings on the farm. He also seeded 12 acres in 1999 with a mixture of ash, oak, walnut, and sycamore seeds (28,000 per acre), which have grown into a dense forest of 5–8' trees and undergrowth. Those sheer numbers help ward off animals that eat seedling leaves and kill the tree. Planting thousands of seeds per acre, rather than the 700 seedlings per acre recommended by foresters, also helps trees grow straighter due to crowding

For anyone interested in following his lead, Kevin recommends planting trees that will thrive in your particular soil. That's why 75 percent of his plantings have been walnut. Also, he says, plant in small plots (10 acres or less); don't expect to do a whole farm in a year.

—WOOD editors

Free online video shows leg-making technique in action

To show you how easy it really is to make the curved, tapered legs of the bow-front table in issue 172 (October 2006), we decided to demonstrate. Visit woodmagazine.com/curvtapleg to watch Senior Design Editor Kevin Boyle machine one of those handsome legs from start to finish.

—WOOD Editors

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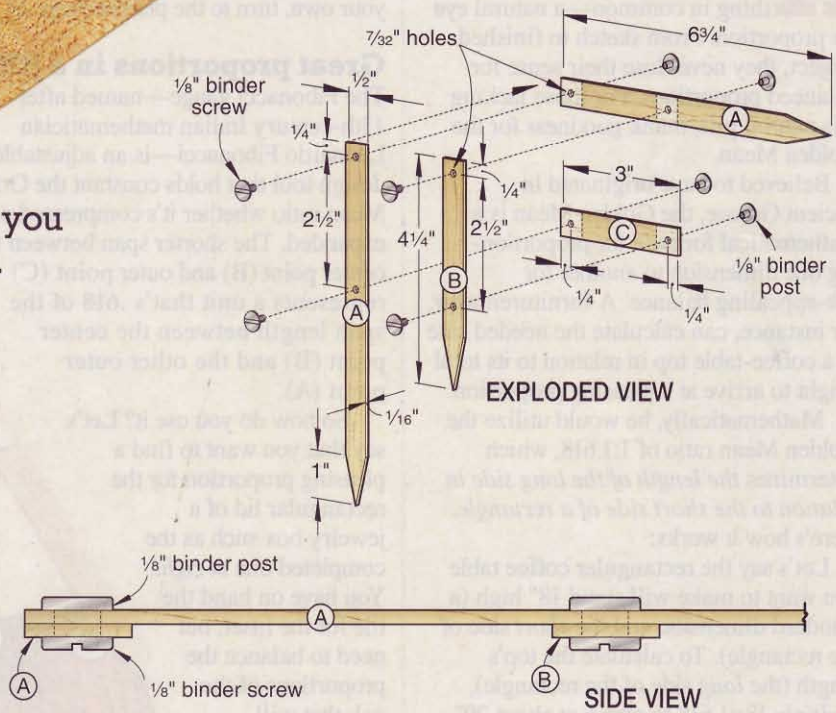
- **Updates to previously published projects:**
  For an up-to-date listing of changes in dimensions and buying-guide sources from issue 1 through today, go to **woodmagazine.com/editorial**.

Fibonacci gauge

Build this age-old guide to help you create pleasing project designs.



The Golden Mean of measuring was used by both the ancient Greeks and Egyptians to design their buildings and monuments for pleasing proportion. You can do the same for your projects by using the Fibonacci gauge. See *page 14* for an explanation of how to use this intriguing and effective tool.

To make your own, start by cutting the arms (A, B, C) to width and shape from 1/16" dense hardwood stock. (We used figured maple, but any wood will do.) Transfer the hole centerpoints from the full-size patterns, found in the *WOOD Patterns*® insert, to the arms. Drill the 7/32" holes where marked and add finish to each arm. Join the pieces in the configuration shown on the Exploded View and accompanying Side View drawings with binder posts and screws, using Locktite to prevent the screws from loosening over time.

Materials List

Parts		FINISHED SIZE T	W	L	Matl.	Qty.
A	outside arms	1/16"	1/2"	6¾"	C	2
B	inside arm	1/16"	1/2"	4¼"	C	1
C	cross arm	1/16"	1/2"	3"	C	1

Material key: C-choice of wood.

Source

Kit. 1/8" binder posts and screws (4), 2 ounce #609 Locktite (1), Kit #300CAL, $9.95 ppd. plus $4.95 for each additional kit. Schlabaugh and Sons Woodworking, 720 14th Street, Kalona, IA 52247. Call 800/346-9663.

how to use the Fibonacci gauge to proportion projects to please the eye

For thousands of years, architects and artists have followed the principle of the Golden Mean to make designs look just right. With this simple invention you can, too, but without all the math!

All the best furnituremakers and woodturners seem to have one thing in common—a natural eye for proportion. From sketch to finished project, they never lose their sense for balanced proportions. For those lacking this natural gift, thank goodness for the Golden Mean.

Believed to have originated in ancient Greece, the Golden Mean is a mathematical formula for proportioning one dimension to another for eye-appealing balance. A furnituremaker, for instance, can calculate the needed size of a coffee-table top in relation to its total height to arrive at a pleasing proportion.

Mathematically, he would utilize the Golden Mean ratio of 1:1.618, which determines *the length of the long side in relation to the short side of a rectangle.* Here's how it works:

Let's say the rectangular coffee table you want to make will stand 18" high (a standard dimension and the *short* side of the rectangle). To calculate the top's length (the *long* side of the rectangle), *multiply* 18×1.618 to arrive at about 29". Since the short side of the rectangle is 18", that dimension represents the top's width. (No need for fractional exactness.) See the **Drawing** *below* for how it's done.

Too much math? Turn to the Fibonacci gauge for proportions at a glance. (To build your own, turn to the plan on *page 13.*)

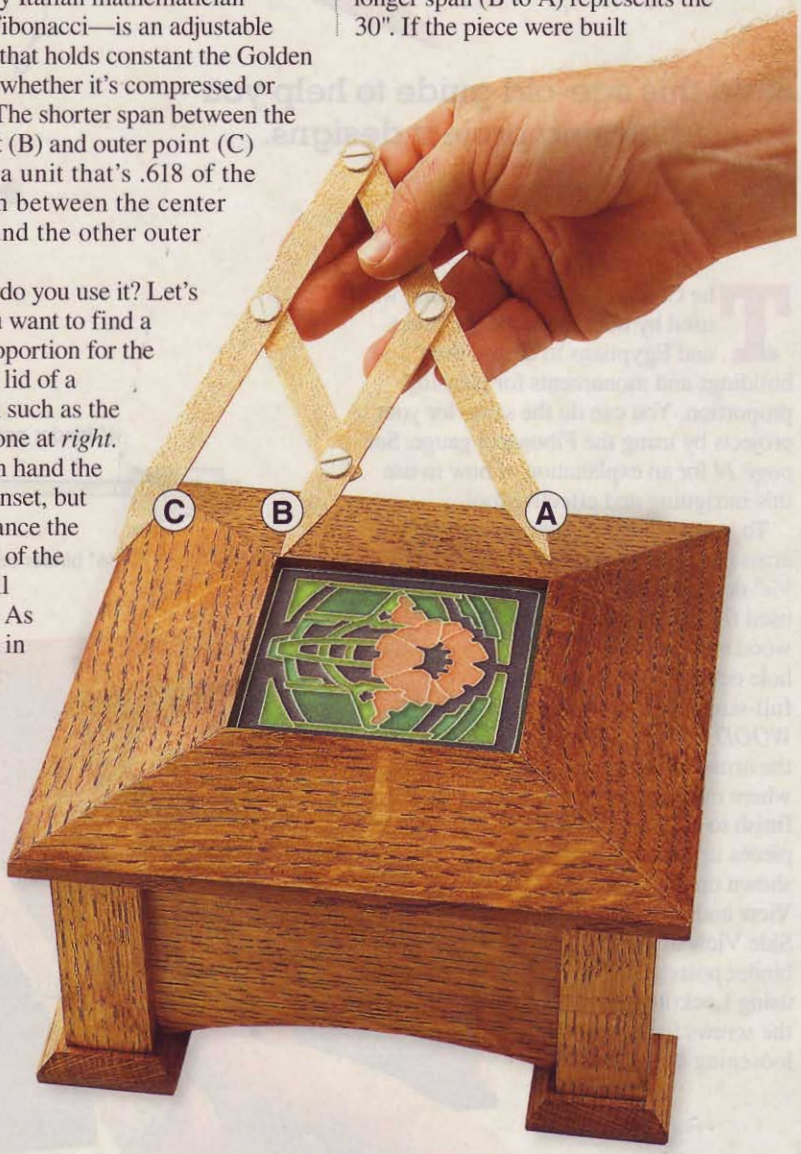
Great proportions in a jiffy

The Fibonacci gauge—named after 13th-century Italian mathematician Leonardo Fibonacci—is an adjustable design tool that holds constant the Golden Mean ratio whether it's compressed or expanded. The shorter span between the center point (B) and outer point (C) represents a unit that's .618 of the span length between the center point (B) and the other outer point (A).

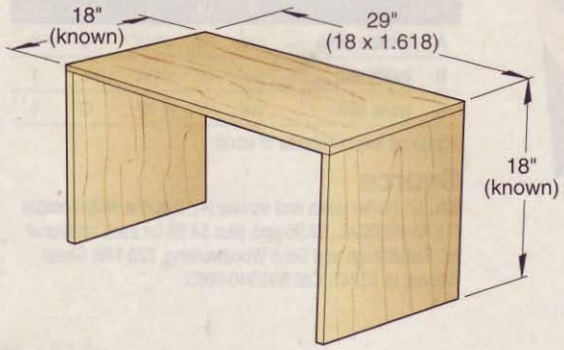
So how do you use it? Let's say that you want to find a pleasing proportion for the rectangular lid of a jewelry box such as the completed one at *right.* You have on hand the tile for the inset, but need to balance the proportions of the oak that will surround it. As you can see in the photo at *right*, by spreading the gauge so that the distance between the center point (B) and the farther outer point (A) covers the width of the tile inset, the shorter span between the center (B) and the other point (C) automatically represents the proportional width of the surround.

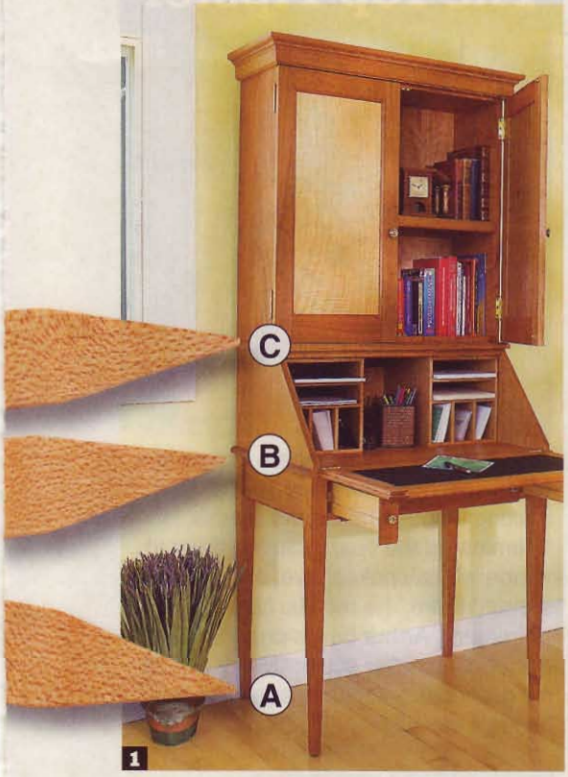
You also can use the Fibonacci gauge to find the proportional dimensions for a piece of furniture (or its parts) shown in a photo. For example, you like the looks of a tall drop-front secretary and storage cabinet featured in a magazine, but no dimensions are given. You can, however, find its approximate proportional height with the Fibonacci gauge.

How? Start by assuming that the distance from the floor to the desk's writing surface is a fairly standard 30". Place the gauge on the photo so that the longer span (B to A) represents the 30". If the piece were built



THE GOLDEN MEAN RATIO





proportionately, the outer point (C) should rest at or close to the top of the pigeonholed center section, as you can see in **Photo 1**. Since the shorter span (B to C) represents .618 of 30", the center section's height comes in at about 18½". To find the height of the upper cabinet, reverse the gauge so that the smaller span (B to C) spreads across the center section. The point of the larger span (B to A) should rest at the cabinet top, revealing that its height is close to 30", as shown in **Photo 2**. The total height of the unit equals the sum of the three parts: 30" + 18½" + 30" = 78½". Use the same method to find widths.

Remember, a Fibonacci gauge isn't for precise measurement. But using one will always get you close to pleasing proportions.

Interested in seeing the Fibonacci gauge in action? Visit woodmagazine.com/fibonacci to see a video of Jeff Mertz proportioning a table using the process described in this article.

Written by **Peter Stephano**
Illustration: **Lorna Johnson**

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shop tips

Helping you work faster, smarter, and safer

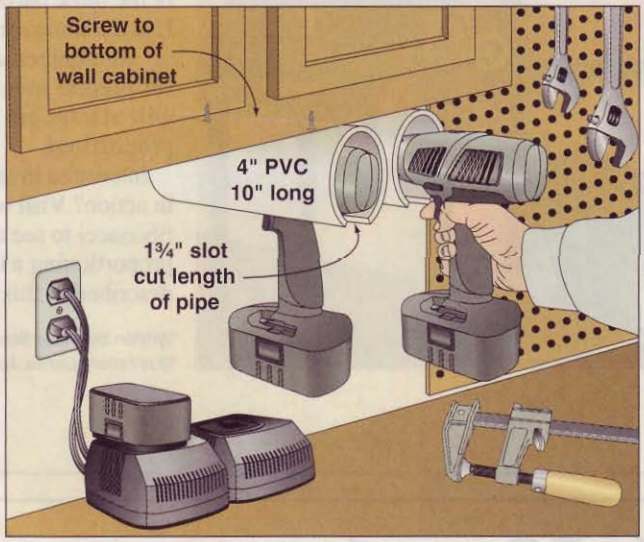
Cordless drill holsters hang 'em high

Workbench space is at a premium in my shop, so I made holsters for my cordless drills, as shown. To make these handy hangers, I cut 4" PVC pipe into 10" lengths, and then used a jigsaw to cut a slot lengthwise in each piece wide enough to fit my drills' handles. (I made mine 1¾" wide; yours may need to be wider or narrower.)

Sand or file the cut edges of the PVC to prevent damaging the soft grips on the tools. Finally, drill a pair of holes inside the pipe, directly opposite the slot, and screw the holsters to the bottom of a shelf or cabinet. You may need to install a filler strip on the bottom of the cabinet to shim the holsters if your cabinets have a deep recess beneath.

—Arthur Hoff, Lakeland, Fla.

top shop tip



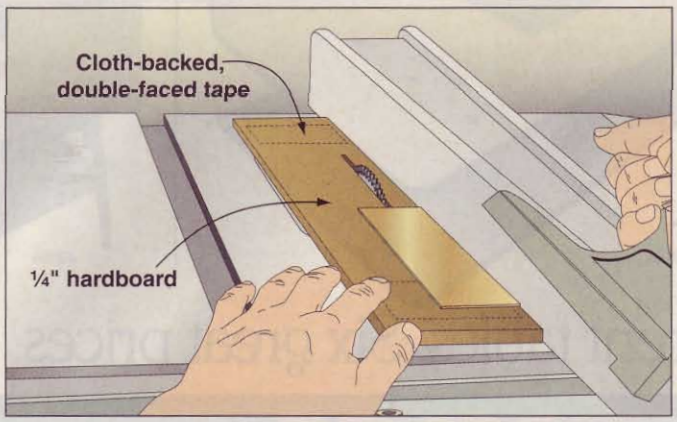
Raise the table to cut super-thin materials

Recently, I was making wooden chests for my young daughters and decided to use brass accent strips for edging. When I tried to cut the strips with my tablesaw, the thin material would slide underneath the tablesaw's fence, making a precise accurate cut virtually impossible. I knew I needed to somehow raise the table next to the fence.

To solve the problem, I first positioned the fence where it needed to be for my cuts. Next, I lowered the tablesaw blade and used cloth-backed, double-faced tape to firmly adhere a 6"-wide scrap of ¼" hardboard to the tabletop. With the hardboard mounted, I started the saw and gradually raised the blade through my sacrificial table.

As a final measure, I made a job-specific pushblock so I could safely feed the thin brass through the blade. If you have trouble getting the pushblock's heel to hold the edge of the thin material, you can add double-faced tape to the bottom of the pushblock, too. This setup helps me make safe, accurate cuts with thin metals and other laminate materials.

—Donovon Harsch, Regina, Sask.

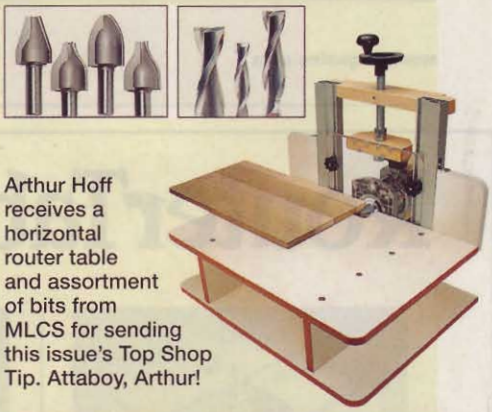


continued on page 18

The Top Tipster

Photo: Robin Phillips

Arthur Hoff actually made a career of woodworking in the early 1960s, making wooden helicopter blades. "I laminated the spars, carved them to shape with a spokeshave, and then sanded them," he recalls. Now in retirement, Arthur builds projects of a decidedly smaller scale: "Every one of my granddaughters has a jewelry box," he says proudly.



Arthur Hoff receives a horizontal router table and assortment of bits from MLCS for sending this issue's Top Shop Tip. Attaboy, Arthur!

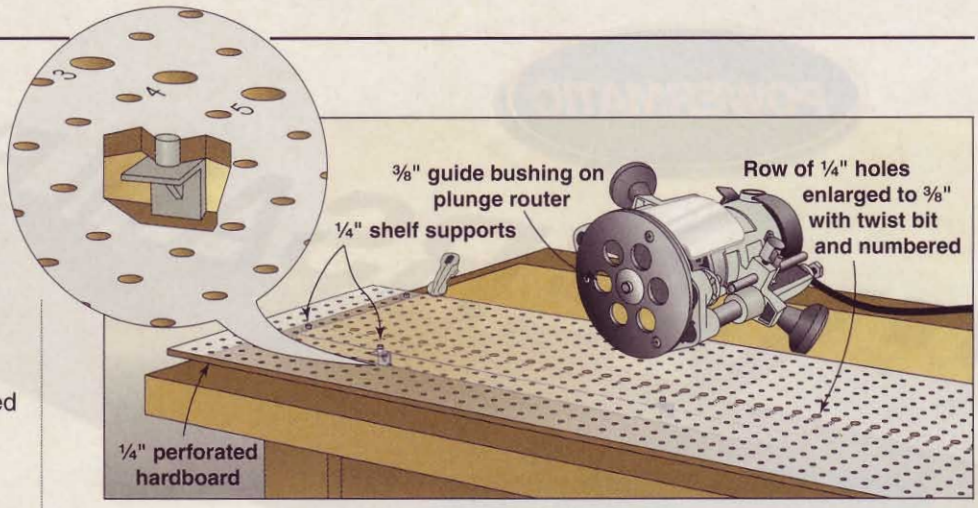
Top tips earn tools!

Describe how you've solved a workshop stumper and you'll get $75 if we print it. And, if your tip garners Top Shop Tip honors, we'll also reward you with tool treasures worth at least $250.

Send your best tips, along with photos or illustrations and your daytime phone number, to: **Shop Tips, WOOD Magazine, 1716 Locust St., LS-221, Des Moines, IA 50309-3023**. Or e-mail tips to: **shoptips@woodmagazine.com**. Remember to include your contact info in the e-mail as well.

Because we publish only original tips, please send your tips only to *WOOD®* magazine. Sorry, submitted materials can't be returned.

Top-shelf template for boring multiple holes



Not long ago, I built some cabinets for my office with adjustable shelving. Faced with marking and drilling hundreds of holes, I created the boring template shown at *right*. With it, I use my plunge router with a guide bushing to consistently create cleaner holes than I could ever make with a drill bit. And a few carefully placed shelf supports quickly align and locate the template over the workpiece.

I made mine from a piece of white ¼" perforated hardboard about 15×60". Using a drill press, I enlarged the center row of holes to fit my plunge router's ⅜" guide bushing. I then numbered the holes so I know where to stop boring.

To use the template, I first laid out the approximate line for the shelf-pin holes on my first case side. Next, I indexed the jig to the workpiece by placing the row of enlarged holes directly over that layout line. Then, I installed a pair of ¼" shelf supports *underneath* the template in the two adjacent rows nearest the workpiece edge, as shown in the drawing. These supports locate the shelf-pin holes up to ½" off that first line, but that's okay, because the jig duplicates the location on every workpiece. After snugging the supports against the edge and end of the workpiece, I clamped the template and workpiece in place.

Finally, I inserted the guide bushing into the first desired hole, plunged a ¼" straight bit to depth to bore the shelf-pin hole, and repeated for each hole in the row. After boring the entire row, I simply moved the shelf support from one edge to the other (but not moving the top support) and repeated the hole-boring process. The results are amazingly accurate because the template always registers off the top edge of the workpiece.

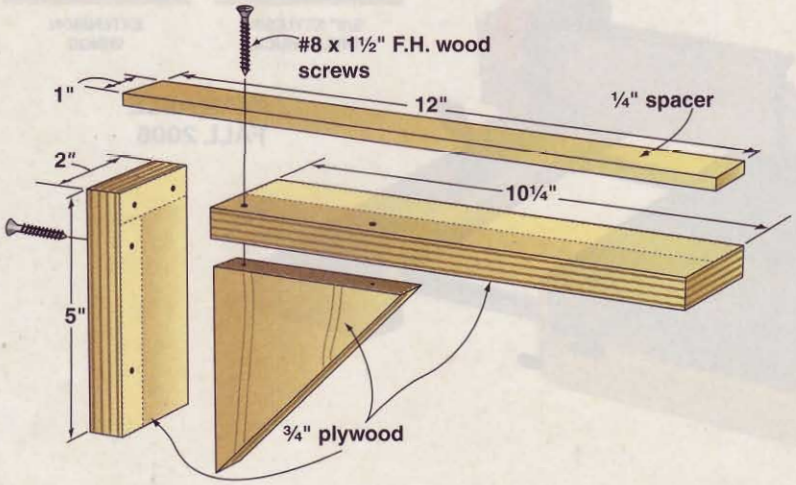
—Robert Brosbe, Lancaster, Pa.

Take the guesswork out of mounting drawer slides

Mounting a drawer box so its face aligns with the cabinet frame can be as frustrating as catching a greased pig. When you're installing full-extension drawer slides, as I like to do, there's even less room for error. My solution was to build a pair of L-shaped drawer supports, as shown *below*, that clamp to the cabinet front and fully support the drawer box while leaving my hands free.

Use the dimensions shown in the illustration to build your supports, remembering to make both a left and right version. The 12" spacer is long enough to extend past the support and rest firmly on the cabinet's face frame for alignment. The spacer on top of the support holds the drawer box the necessary ¼" above the face frame rail. With the box securely supported and accurately spaced, it's simply a matter of extending the drawer slide out until it's flush with the box's front and screwing it into place.

—Paul Bianchina, Bend, Ore.



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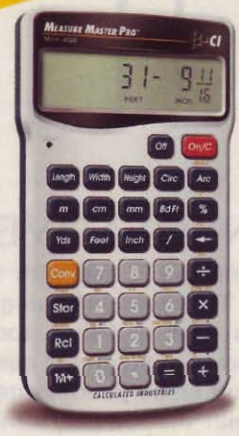

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shop tips

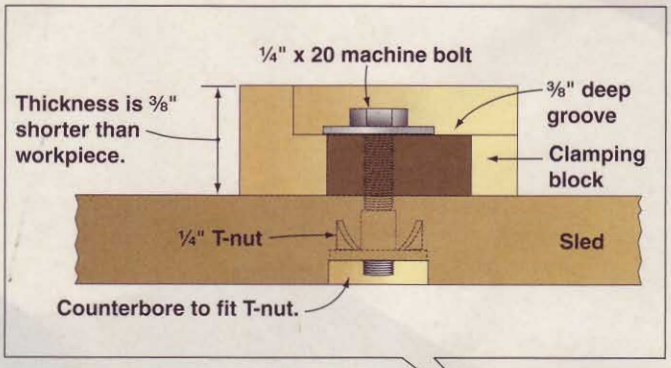
Squaring sled helps clean up laminated parts

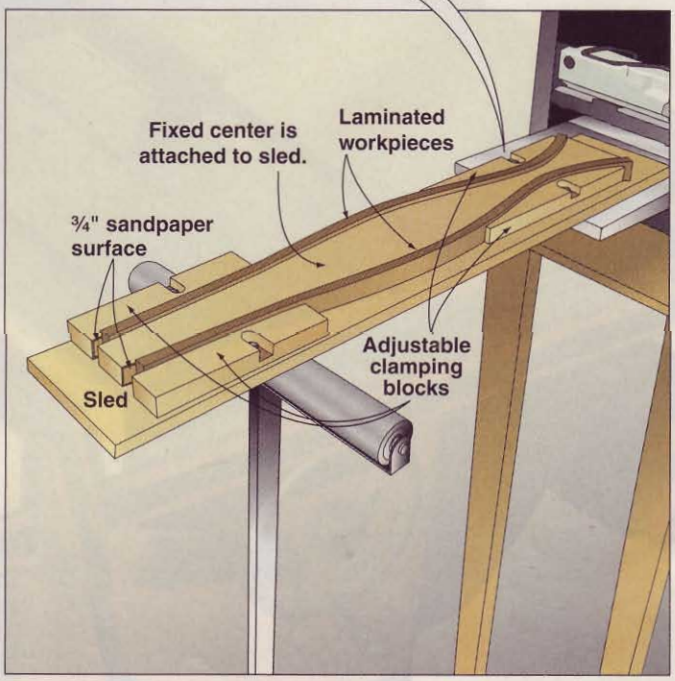
I enjoy making rocking chairs with curved laminated rockers and back braces. After unclamping the laminated pieces from their forms, the layers are never perfectly aligned and globs of hardened glue stick out from the seams. The pieces need to be cleaned and squared up along their edges. Using a jointer is awkward and somewhat unsafe on these narrow curved parts, so I make job-specific sleds that allow me to safely pass the parts through a planer.

The sled shown *below* holds the chair's curved back braces, and features a fixed form in the middle and adjustable clamping blocks that match the contour of the braces. The fixed form and clamping blocks should be at least ⅜" lower than the thickness of the laminated workpiece to prevent damaging the form as I plane.

After removing the braces from their glue form, I scrape off as much hardened squeeze-out as possible to minimize wear on my planer knives. Then I drop the braces into this sled, capture them with the adjustable blocks, then run them through the planer, taking shallow cuts. When I'm satisfied with that surface, I flip the braces and put them in opposite sides of the form, so I can machine both edges with one sled.

—Joe Godfrey, Forest City, N.C.

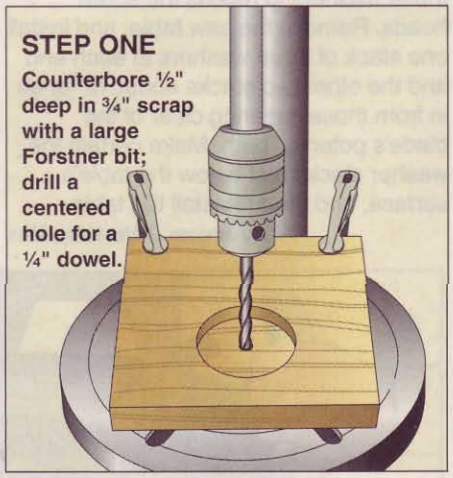


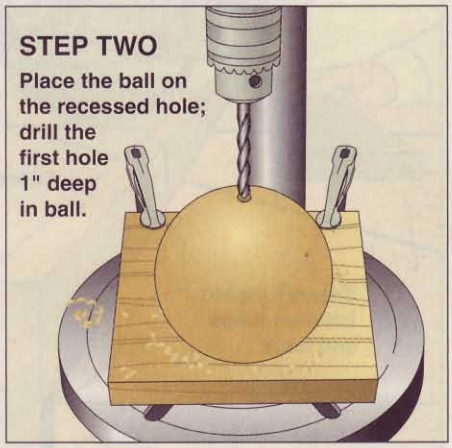


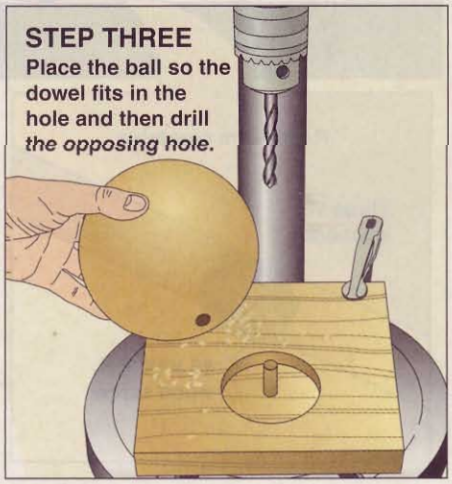
Ball-drilling jig cures "bipolar disorder"

It's not easy finding the opposite poles of a sphere. Recently, I needed to do just that when I was making some decorative spindles using stacked wooden balls. To make a straight spindle, the holes needed to be exactly opposite each other. To accomplish this slippery feat, I came up with the steps shown *below*.

—John Jouas, Cave Creek, Ariz.



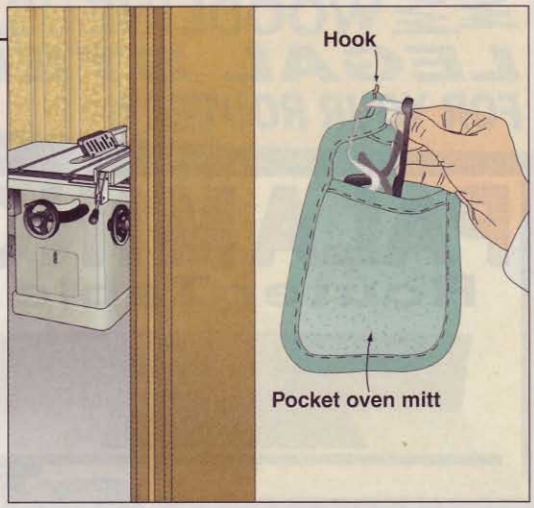




Simple storage for safety glasses

Old oven mitts can be recycled into handy holders for shop safety glasses. The cushioned holder protects the lenses from scratches and can be conveniently stored anywhere. You can hang them on walls or cabinets or, with the help of a magnetic hook, on the side of your tablesaw or other large tools. You could even use one to safely store a dial caliper by your planer.

—Dustin Davis, Cumberland, Md.



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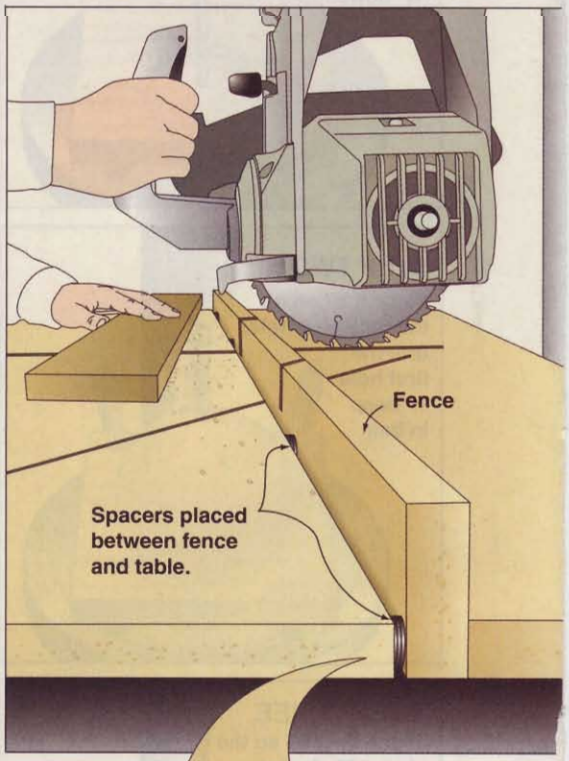
shop tips

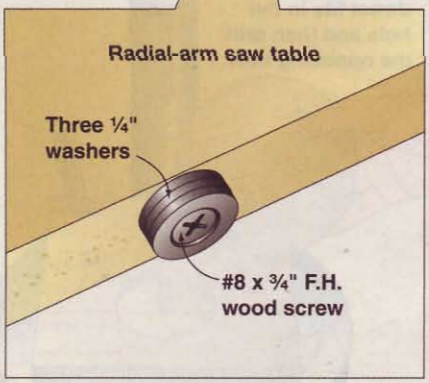
Self-cleaning radial-arm saw table

It doesn't take much dust nestled in the corner between a radial-arm saw's fence and table to mess up an otherwise accurate cut. Eliminate the problem by creating a gap between the fence and table that lets dust drop out of the way.

To bump out the table, select twelve ¼" washers of equal thickness. Using a countersink, chamfer the inside of four of those washers to recess the screw heads. Remove the saw table, and install one stack of three washers at each end and the other two stacks about 12" or so in from those, steering clear of the blade's potential path. Make certain the washer stacks rest below the table's surface, and then reinstall the table.

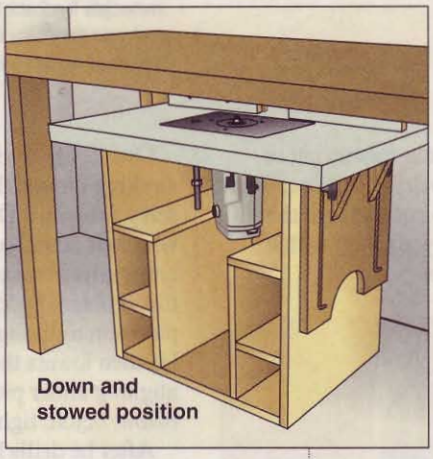
—Perry Johnson, Golden Valley, Minn.





Telescoping router table for compact storage

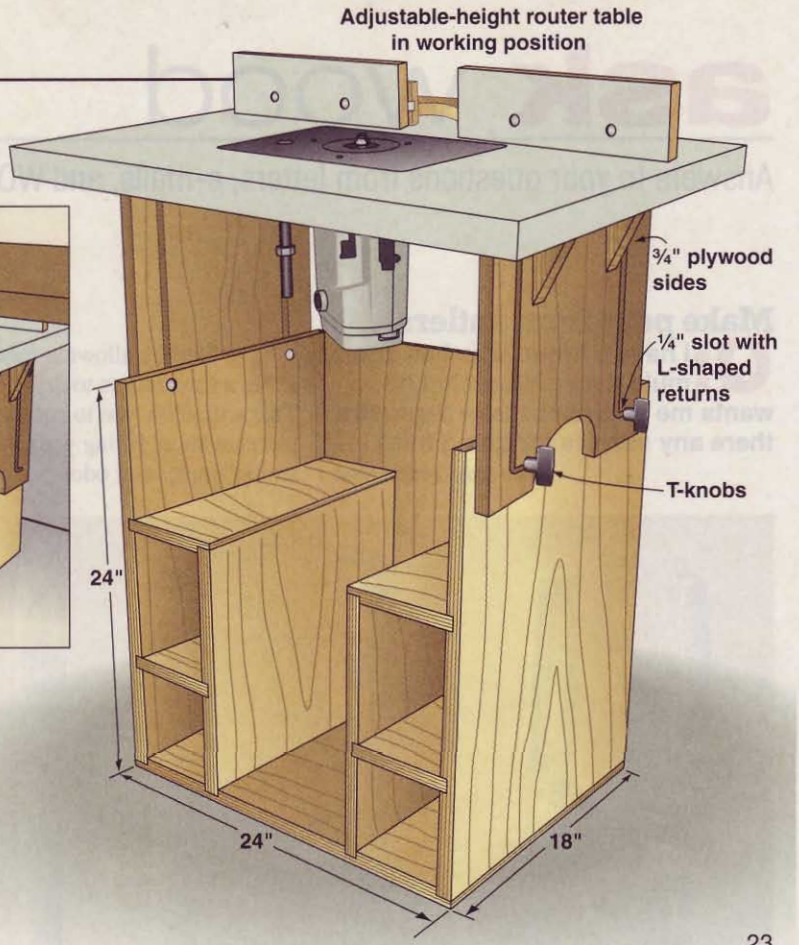
I needed a router table, but didn't have room in my garage shop for another large stationary cabinet. My solution is a telescoping table that can slide down and fit under a work counter when not in use.



Down and stowed position

First, build the base to your desired dimensions so the entire assembly will fit under the counter. (The dimensions shown should work in most situations.) Cut ¼"-wide slots as shown in the table sides for the telescoping function. The L-shape of the slots helps stabilize the table when it's in the working position. Use T-knobs, carriage bolts, and locking washers to secure the sides to the base. Now you have an easily stowed router table that's ready to come out and work like a big-league tool.

—Jim Treece, Knoxville, Tenn.



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Make pens from antlers

Q: I have a friend who has some mule deer antlers that he wants me to turn to make pens. Are there any secrets for doing this?

Dean Cody, Olympia, Wash.

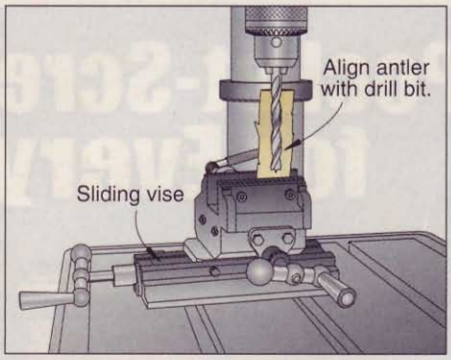
A: Start by allowing freshly cut or shed antlers to dry for a year, Dean. That will allow you to cut and turn the pieces without filling your shop with a strong, unpleasant odor.

Pens by turner Jerry Selover include places where the outer surface of the antler remains.

One key to turning pieces of antler is working around their irregular shapes. Jerry Selover, a Des Moines, Iowa, turner who makes and sells pens fashioned from antlers, like those shown *below left*, solves this problem by loosely mounting the pieces in a sliding vise on his drill press. He then lowers the bit to use as a guide for aligning antler pieces vertically, as shown *below*, before tightening the vise.

After he drills holes for the center sleeve and mounts the pieces of antler on a mandrel, they turn much like wood using just a roughing gouge and a skew. Jerry then protects his pens by quickly wiping on a slow-curing cyanoacrylate to fill the pores and leave a matte sheen.

Different parts of the antler have different textures and color. Pieces cut at or near the tips are more dense and pale than the porous, darker sections found near the base.

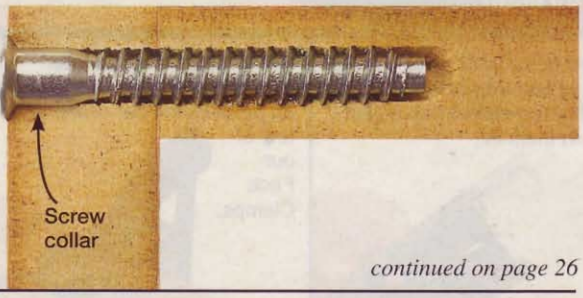


Plywood vs. fiber core

Q: While shopping for oak veneer plywood to make a dresser, I ran across oak veneer panels with a medium-density fiberboard (MDF) core. I chose plywood because the plans called for screwing the pieces together, and I figured plywood holds screws better. Did I make the right call?

—Mark Ball, Duluth, Minn.

A: You did fine, Mark. As the stronger and lighter of the two choices, plywood has more holding strength when using conventional wood screws. Should you want to experiment with MDF-core sheet goods, strengthen your joints with special cabinet connecting screws available from such suppliers as McFeely's (800/443-7937 or mcfeelys.com). Unlike wood screws, where the collar diameter narrows above the threads, the collar below the heads of these screws is as wide as the threads to help hold the screw in place while the threads gently grip the edges of the pilot hole, as shown in the cutaway view *below*. This fastener also can be used to connect pieces of melamine-covered particleboard.



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Breathe easy

Q: I recently bought an HVLP sprayer. So far, I've applied water-based finishes while wearing just a cheap respirator. I'd like to get a better respirator for spraying other types of finishes.

—Tim Hollefsrud, Pierre, S.D.

A: If you're wearing just a disposable paper filter mask now, Tim, a respirator would be a big improvement. Any respirator you buy needs to pass two crucial tests.

First, the respirator must fit tightly against your face to keep fumes from bypassing the filters. To test for a tight seal, fit the respirator to your face as the manufacturer recommends. Then remove the filter cartridges and place your hands tightly over the cartridge mounts. Try to inhale and see if air is slipping in around the edges of the mask. If so, adjust the mask until you achieve a tight fit or try a different mask. Something as simple as facial hair can interfere with a mask seal.

Second, check whether the respirator can be fitted with the correct cartridges for the finishes you'll be spraying. Look for the filter's National Institute for Occupational Safety and Health (NIOSH) rating. Avoid filters with an "N" rating, which won't trap airborne oil particles. Use an oil-resistant "R" filter or oilproof "P" filter. In addition to the letter, there will be a number rating of 95, 99, or 100, depending on whether the filter works at 95, 99, or 99.7 percent efficiency. Any of these will be adequate for most household spray finishing jobs.

For protection when spraying both water-based and solvent-based finishes, look for a filter with an organic vapor rating. Some filter cartridges may be rated for both particle and organic vapor protection.

To protect your eyes and lungs at the same time, consider a full-face mask. Examples include AOSafety's QuickFit (AOSafety, 800/225-9038 or aosafety.com), shown *above right*, or the 3M 6000 with a full facepiece (800/328-1667 or 3m.com/occsafety). These cannot be worn over glasses, but some types can be fitted with built-in prescription lenses. Removable plastic films can be applied to the facepieces to keep your vision from being obscured by overspray buildup.

This full-face mask uses separate particle and organic vapor filters that interlock.

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Circle No. 678

Satin finishing myth: Busted

Q: I want a satin finish for my cherry dining table, and I have a supply of both satin and gloss varnish. Assuming I brush on three coats, which is the best way: two coats of gloss and a final coat of satin, or three coats of gloss followed by rubbing out the finish?

Adam Bedford, Rockford, Mich.

Rubbing out a finish allows you to control the sheen while removing surface imperfections such as brush strokes and dust nibs.

A: Conventional wisdom once called for applying gloss on all but the final coat, which would be satin, Adam. Some believed multiple coats of satin might obscure the grain; others thought gloss finishes were more durable than satin finishes. Bob Flexner, author of *Understanding Wood Finishing*, tested the grain-obscuring theory and found there was no noticeable difference in wood grain clarity between sample surfaces with gloss undercoats and those where satin finish was used for each coat. That's because the fine silica flatting agents buried beneath the surface of a satin finish become invisible. Only the granules on the surface diffuse reflected light to create a satin sheen. As for hardness, satin finish is just gloss finish with the added flatting agent, so there's no difference in hardness.

We recommend combining elements of your two choices. Apply three coats of satin finish. Then rub out the topcoat to remove surface flaws, such as trapped dust. For a super-smooth finish, first level the surface by sanding up to 600 grit followed by 0000 steel wool. Then rub the surface with 2F and 4F pumice in mineral oil for an even satin sheen. Use satin finish on the routed edges and any other areas where you don't rub out the finish.

continued on page 28

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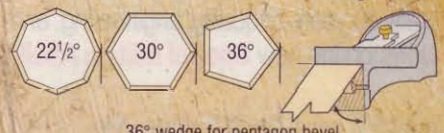

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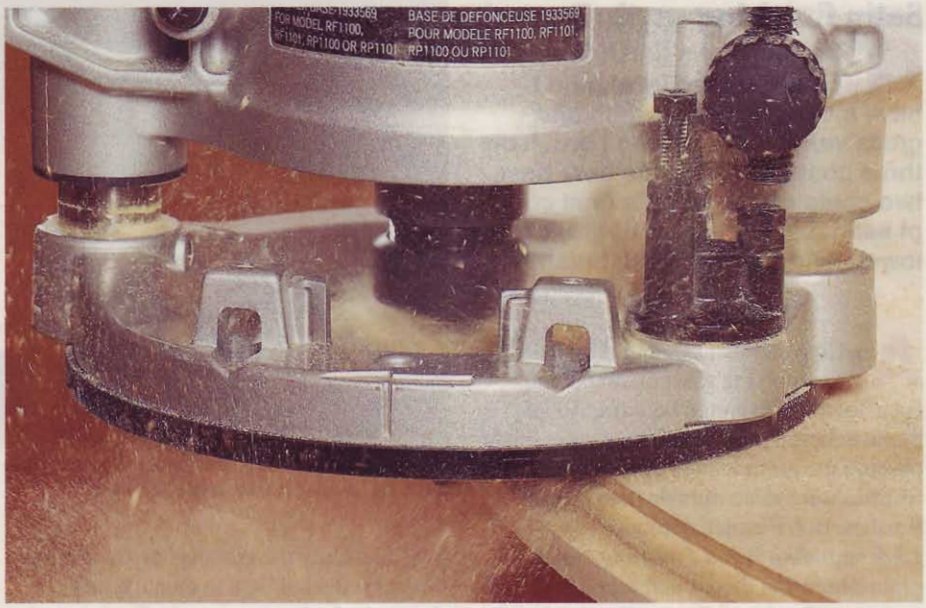
Circle No. 803

Sticky router situation

Q: I use a Porter-Cable router 90 percent of the time with a fixed base in a table and 10 percent with the handheld plunge base. Recently, I was plunge-routing ¾" MDF. After finishing the job, I could no longer remove the router from its plunge base. I assume it's clogged with fine MDF powder. What should I do to get the router free?

—Darrell Phillips, Mt. Desert, Maine



A: If fine dust has packed the spiral grooves in the base, that could be your problem, Darrell. Start by trying to remove as much dust as possible using compressed air. An aerosol penetrating oil or WD-40 also may loosen up the jam, although you'll later have to remove all lubricant from the motor housing and base to avoid attracting more contaminants.

The experts at Porter-Cable offered another possible explanation for this jam. Transferring the motor between bases may have produced an accidental nick on the motor housing, raising a burr that keeps the housing from turning inside the base. If you spot a small nick or raised sliver of metal, carefully remove it with a fine mill file or piece of sandpaper.

While you're at it, check for other possible contaminants that may cause the housing to stick in its base. These include errant dabs of glue on the motor housing or wood chips in the grooves.

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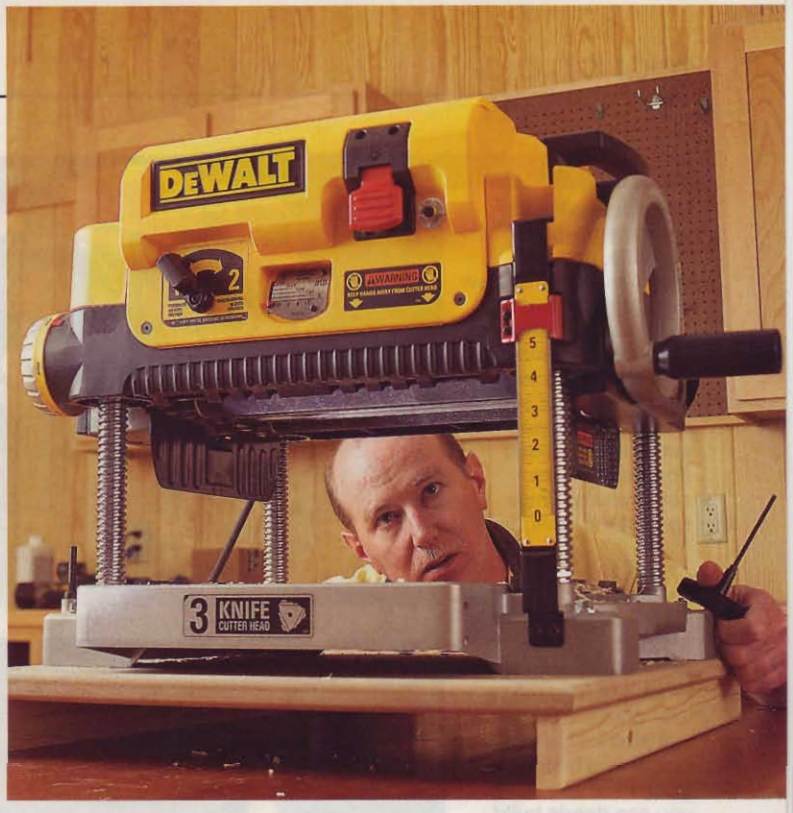
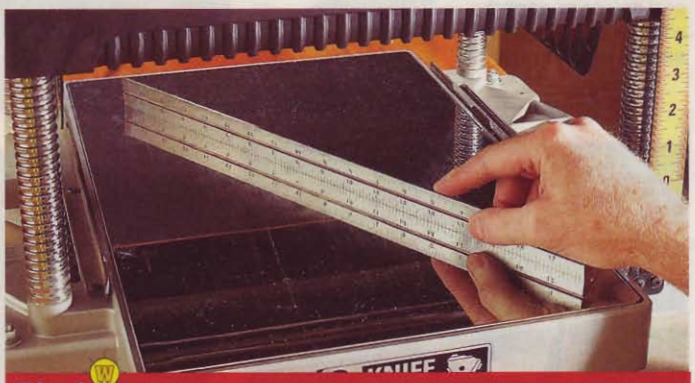
10 tune-up tips for perfect planing



Your benchtop planer takes a beating in normal use. Give it routine maintenance for glassy-smooth results board after board.

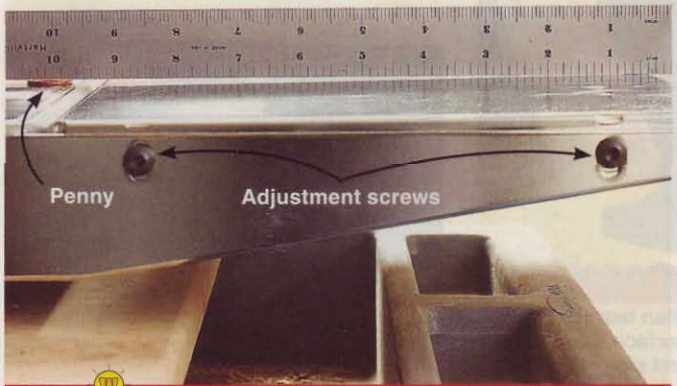
Few benchtop planers will continue to deliver the kind of results you want—and expect—without maintenance. Getting and keeping your planer in top condition is the key that unlocks the door to peak planer performance. Although you might occasionally run across circumstances that require professional repair, such as a cutterhead out of alignment with the feed rollers, you can successfully perform the following maintenance to keep your machine in top shape. Just be sure to read your planer's manual for procedures specific to that make and model. And always unplug your planer before working on it.

Here are some basic ideas to remember: The cutterhead cuts parallel to your planer's table as boards are fed across it, so keep it flat, clean, and smooth. Keep your planer and its parts that contact the wood clean and free of chips, dust, sappy residue, and lubricants. A little TLC will help your planer be a reliable workhorse in your shop for many years.



Tip 1

Check the planer table for flatness with a long straightedge. Assess the length and width of the table as well as diagonally. If your table has any warped or low spots—which are rare—contact the manufacturer for assistance.



Tip 2

To reduce snipe, set the infeed and outfeed extension tables so that the outer ends are 1/16" (about the thickness of a penny) higher than the planer table.

Tip 3

Clean the planer table with mineral spirits; then apply a coat of paste wax so boards will glide across smoothly as the feed rollers pull them. Buff the wax with a soft cloth.

continued on page 38

Tip 4

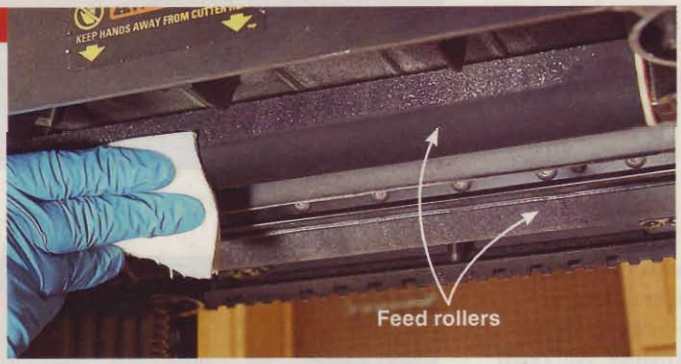
Use dust-collection equipment when possible, and use compressed air to blow away debris from the cutterhead, rollers, and table surface with each use. This helps avoid feed rollers that slip, and dimpled wood surfaces that result from feed rollers compressing chips against the workpiece.

Tip 6

Check the motor brushes every 100 hours for wear on the carbon faces. Replace them when the carbon is less than ¼" long. Excessive motor load, caused by taking deep cuts in wide stock, could hasten wear.

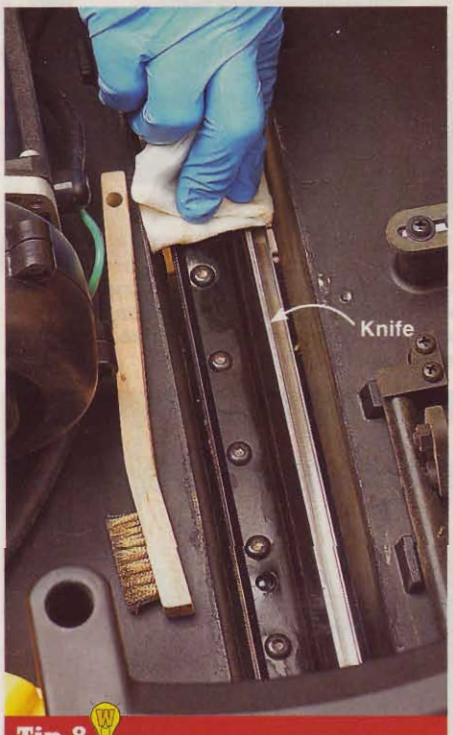
Tip 5

When the feed rollers lose grip, a workpiece can stall inside the planer and become gouged or burned. If you see debris build up, wipe the rubber feed rollers with mineral spirits or naphtha using a clean rag to ensure a good grip.



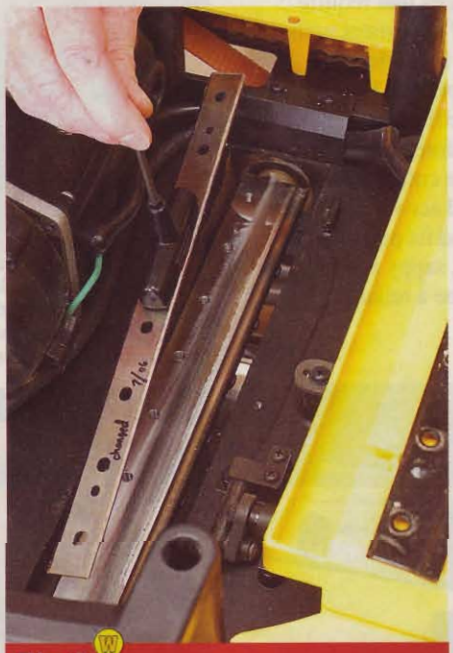
Tip 7

Clean the head elevation screws and guide posts by blowing away dust and chips with compressed air. Use a brass-bristle brush if needed. Then lubricate the posts and threads with dry paraffin wax for smoother movement.



Tip 8

Clean dust and pitch from the knives using mineral spirits and a clean rag or brass-bristle brush. You'll most likely need to do this after planing wood with high sap, tar, or oil content, such as pine or teak. Be careful not to cut your fingers on the knife edges.



Tip 9

When knives dull, they often tear the wood or pull chunks from the surface, so replace or sharpen them at the first sign of dulling. Don't bother sharpening double-edged, disposable planer knives; it proves too difficult to get a consistently sharp and straight edge on all knives—which must match perfectly. Keep a spare set of knives on hand to minimize downtime.

Tip 10

Clean the drive chain and sprockets only if they become covered in dust or chips. Use a brass-bristle brush and compressed air. (Avoid removing grease or lubricant from any exposed gears.)

cool-to-the-touch hot-dish holder

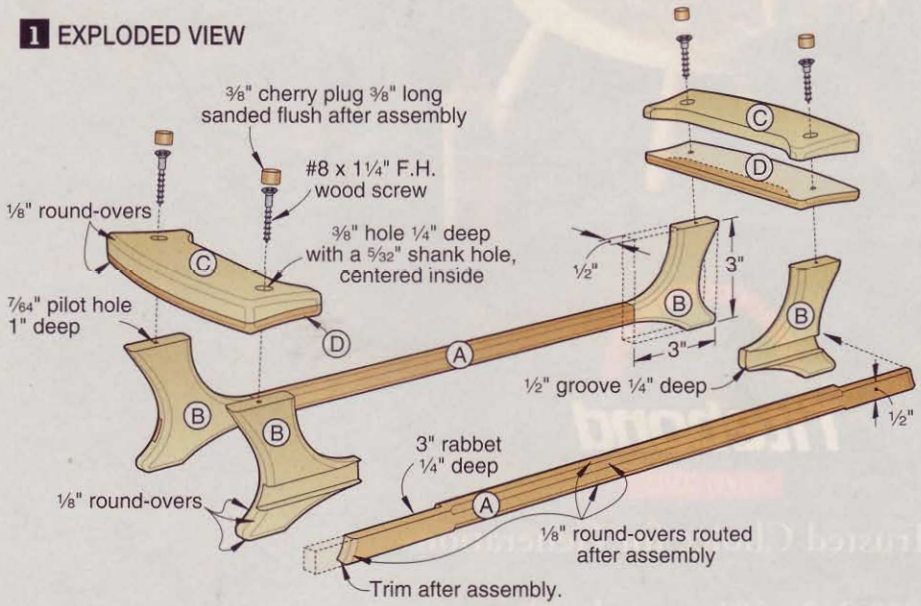
Cut the stretchers (A) and risers (B) to the sizes listed in the **Materials List**. To determine the length of the stretchers, measure the length of your casserole dish and add 2⅜". Cut or rout a ½" groove ¼" deep in the blanks for risers, where noted on the full-size patterns on the *WOOD Patterns®* insert.

Cut a mating 3"-long rabbet on both ends of each stretcher, where shown on **Drawing 1**. Glue and clamp a pair of risers to each stretcher. See one end of one A/B assembly in **Photo A**.

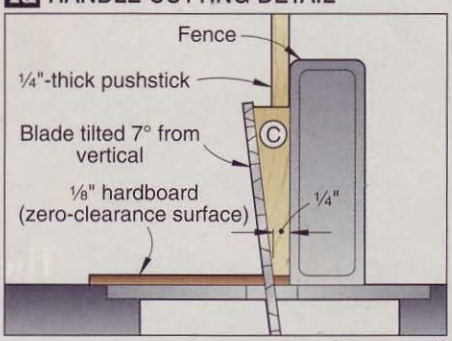
To form the handle tops (C), start by cutting a blank measuring 2¼×16" from ½" stock. Using **Drawing 1a** and the **End View** on the full-size patterns for reference, bevel-rip one edge of the blank at 7°. Sand the surfaces smooth and crosscut two handle tops (C) to 6½". Mark a line ½" in from one edge of each handle top and mark a perpendicular centerline across this line. See the line locations in **Photo A**. Mark a centerline on the handle of your casserole dish. Align one handle top (C) with the dish handle and trace your casserole dish handle profile onto the handle top, as shown in **Photo A**. Bandsaw the handle profile to shape on both handle tops.

Cut the handle bottoms (D) to the size listed. Glue the handle tops and bottoms together face to face. Transfer the handle full-size end and back edge patterns to each

1 EXPLODED VIEW



1a HANDLE CUTTING DETAIL



continued on page 42

lamination and cut them to shape. The front edge of the handle bottoms (D) is not cut to the same profile as the handle tops (C). The resulting ledge supports the dish handle. Drill the mounting holes through the handles (C/D), where marked.

Cut a pair of 4⅛"-long spacers to hold the stretchers/risers (A/B) apart. Now, for securing the handles (C/D) to the stretchers/risers (A/B), clamp the spacers between the stretchers/risers (A/B) assemblies, as shown in **Photo B**. Drill mating pilot holes in the risers (B). Remove the clamps, spacers, and handles for now.

Transfer the full-size pattern to each end of the stretchers/risers (A/B) lamination, and cut the risers to shape. Use a sanding drum to sand the curved edges smooth. Rout a ⅛" round-over on the four assemblies, where noted. Sand the four parts smooth.

Clamp the spacers back in place, and screw the handles (C/D) to each stretchers/risers (A/B), as shown in **Photo B**. Plug the holes and sand them flush with the top of each handle. Finish as desired. (We used satin polyurethane for durability and easy cleaning.)

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	stretchers	½"	½"	*17⅝"	C	2
B	risers	½"	3"	3"	M	4
C	handle tops	½"	2¼"	6½"	M	2
D	handle bottoms	¼"	2¼"	6½"	C	2

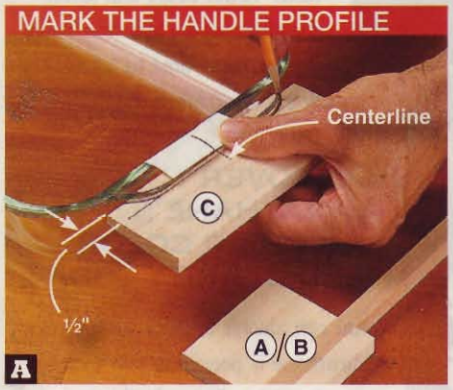
*Measure length of dish and then add 2⅜" to determine length.

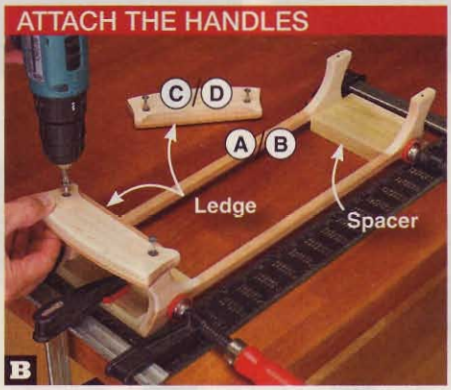
Materials key: C–cherry, M–maple.

Supplies: #8x1¼" flathead wood screws (4), ⅜" cherry plugs (4).

Blade and bits: ⅛" round-over router bit, dado set.

Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine; Lorna Johnson**





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includes 50" Top (#40-088), 3' Cabinet (#40-089), and two Standard vises (40-090). Note: Optional Quick release vise is also available for this model.

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3-in-1 bed for all ages

It's a crib ...

Like a best friend, this bed grows up with your child.

a toddler bed ...

a full-size bed ...

AT A GLANCE

- Overall dimensions:
  Crib
  57⅛" wide × 31¾" deep × 43⅜" high
  Toddler bed
  57⅛" wide × 31½" deep × 43⅜" high
  Full bed
  57⅛" wide × 83" deep × 43⅜" high.
- For a hardware kit, the board feet of lumber, and other items needed to build this project, see *page 54*.

Starting as a crib for a newborn, this "sleep system" easily changes into a bed for a toddler, and then into a full bed, serving a child well past adolescence. Simple decorative connector bolts and concealed cross dowels make these quick changes possible. Build all the parts now and be years ahead, or choose any one of the three beds to meet current needs.

Look for this companion project in the next issue. Designed to match the bed, it serves double duty as a changing table and dresser.

Laminate the legs

1 From ¾" stock, cut six 2⅞×41⅝" boards for the headboard legs (A), six 2⅞×38⅝" boards for the footboard legs (B), and six 2⅞×38⅝" boards for the guardrail legs (C). Then group three boards for each leg, arranging them with the best faces outward. Mark the individual groups for reassembly, and remove the center board from each group. Plane the center boards to the same thickness as the ¾" plywood for the rails H through M. Now install a ¾" dado blade in your tablesaw, and cut notches in the center boards, where shown on **Drawing 1**.

Note: *Be sure to make one guardrail leg (C) center board* with *the upper 2"-wide notch and the other* without *this notch.*

2 Glue and clamp the legs. Avoid excess glue in the mortises by applying glue only to the *center* boards. To keep the ends and edges flush, see the **Shop Tip** *below.* With the glue dry, unclamp the legs. Then remove excess glue from the mortises with a chisel, and scrape excess glue from the edges. Now joint 1/16" from the mortised edges of the legs, and plane the opposite edges to the finished width listed on the **Materials List** on *page 54*. Finally, crosscut the bottom ends of the legs 6" below the bottom mortises, where shown on **Drawing 1**, and cut the opposite end of each leg to finished length.

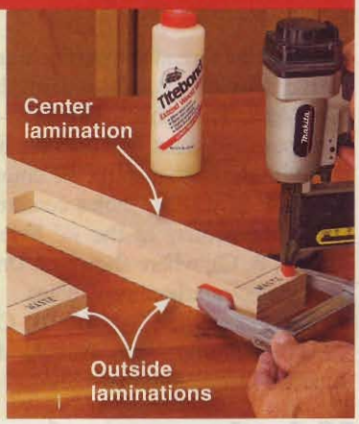
3 Pair the legs with the mortises facing each other, and arrange them in the order shown on **Drawing 2**. Then mark the faces to be tapered near the lower ends. Now lay out the tapers, and bandsaw and sand them to shape.

4 Referring to **Drawing 2**, cut 10° bevels on the tops of the headboard legs (A). Then rout ⅛" round-overs along the edges and ends of all the legs, where shown.

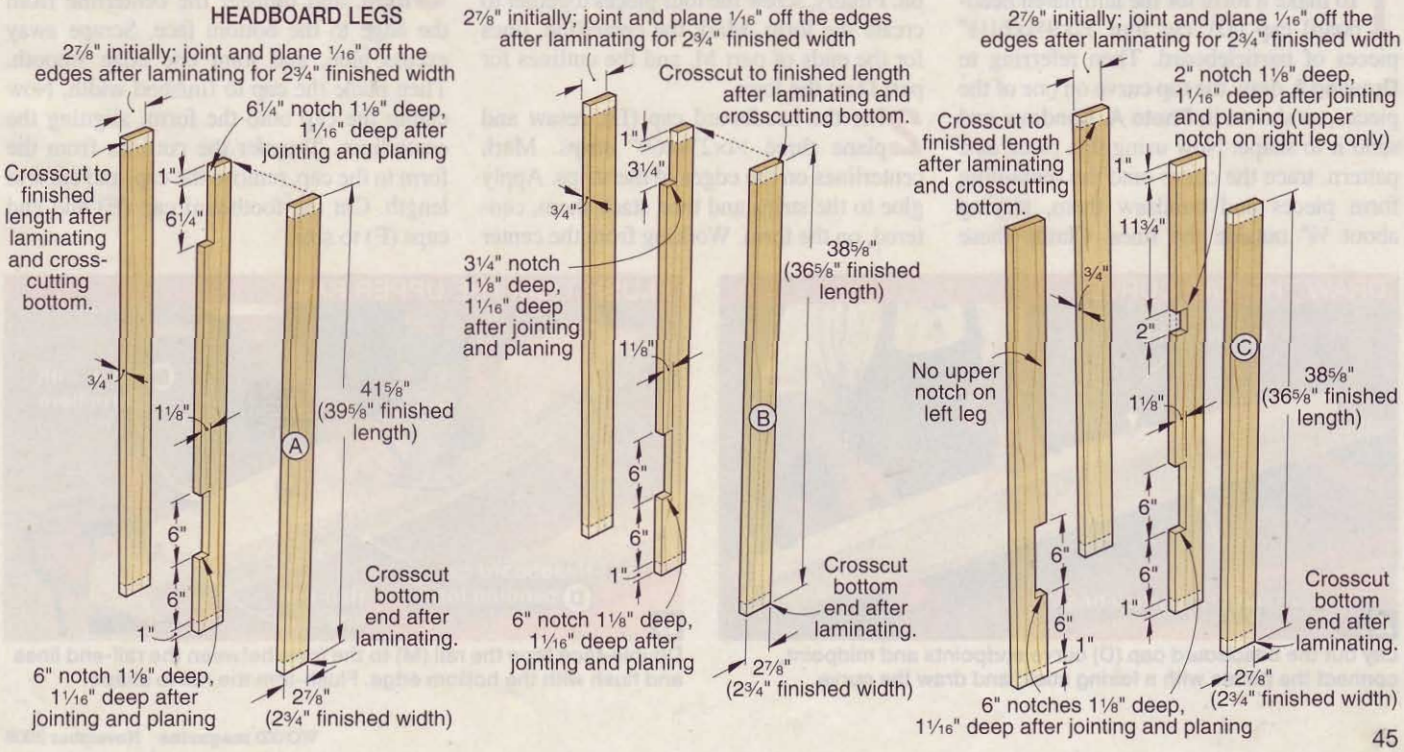
SHOP TIP

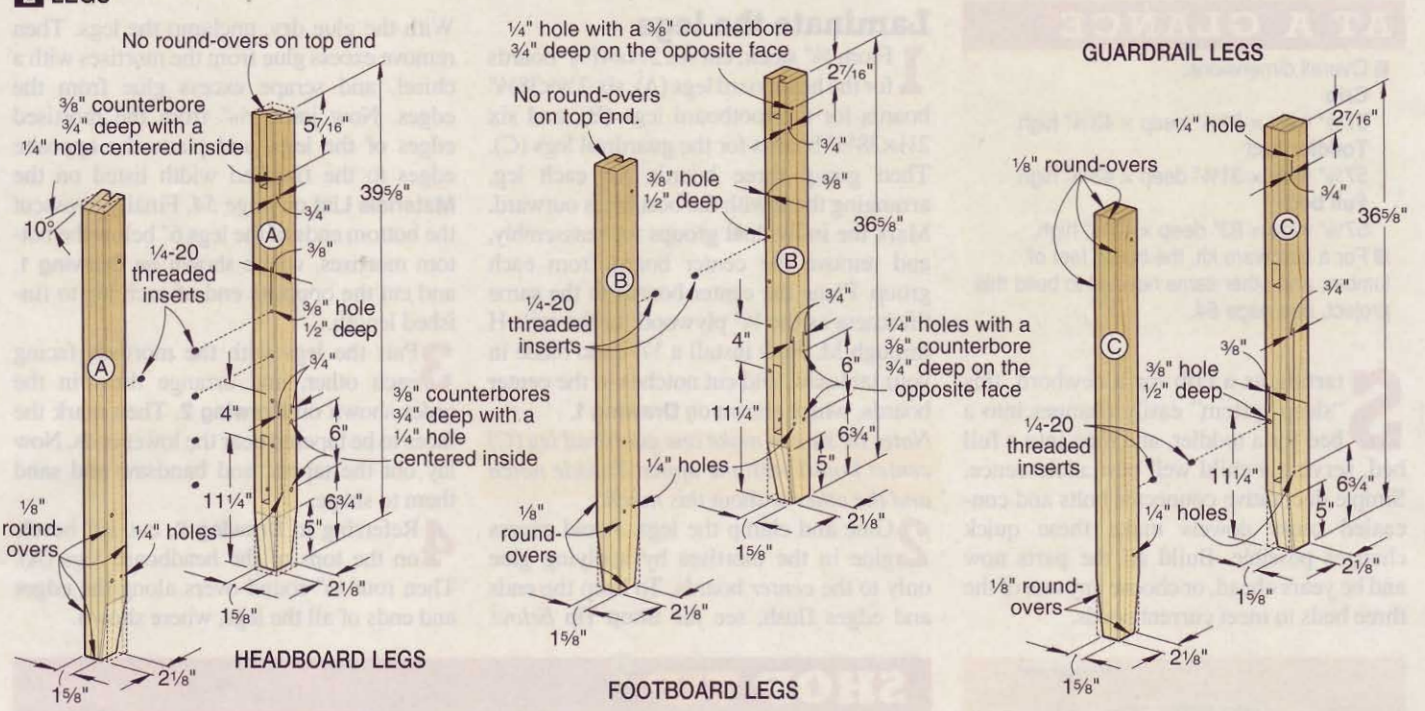
How to keep face-glued parts aligned

Face-glued boards, such as those in the laminated legs (A, B, C) in this project, tend to slip out of alignment when clamped. To prevent this, cut the boards oversize. (In this project, the boards for the legs are initially cut with 1" of waste at each end.) Then apply glue and assemble the boards, driving a couple of nails through the waste area with an air nailer, as shown at *right*. (If you don't have an air nailer, dry-stack the boards and drill pilot holes for 4d finish nails. Then apply glue and drive the nails with a hammer.) Be sure to keep the nails away from the cutline. Apply clamps as usual. With the glue dry, cut the part to finished length.



1 LEG MORTISES

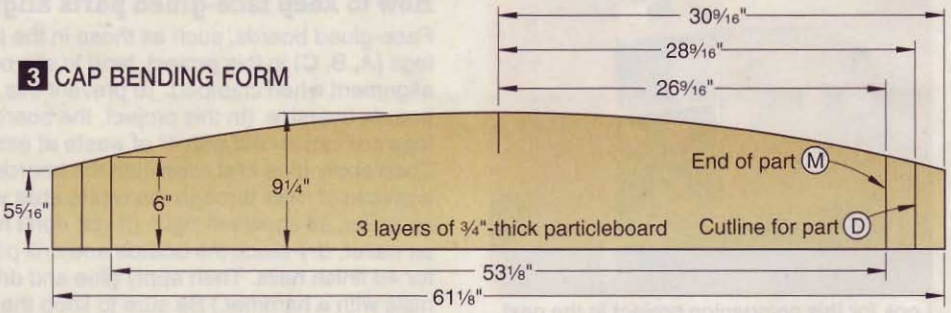

HEADBOARD LEGS
2⅞" initially; joint and plane 1/16" off the edges after laminating for 2¾" finished width
6¼" notch 1⅛" deep, 1/16" deep after jointing and planing
Crosscut to finished length after laminating and cross-cutting bottom.
1"
6¼"
¾"
1⅛"
6"
6"
1"
41⅝" (39⅝" finished length)
A
Crosscut bottom end after laminating.
6" notch 1⅛" deep, 1/16" deep after jointing and planing
2⅞" (2¾" finished width)
FOOTBOARD LEGS
2⅞" initially; joint and plane 1/16" off the edges after laminating for 2¾" finished width
Crosscut to finished length after laminating and crosscutting bottom.
1"
3¼"
¾"
3¼" notch 1⅛" deep, 1/16" deep after jointing and planing
1⅛"
6"
6"
1"
6" notch 1⅛" deep, 1/16" deep after jointing and planing
38⅝" (36⅝" finished length)
B
Crosscut bottom end after laminating.
2⅞" (2¾" finished width)
GUARDRAIL LEGS
2⅞" initially; joint and plane 1/16" off the edges after laminating for 2¾" finished width
Crosscut to finished length after laminating and crosscutting bottom.
2" notch 1⅛" deep, 1/16" deep after jointing and planing (upper notch on right leg only)
1"
11¾"
¾"
2"
1⅛"
6"
6"
1"
No upper notch on left leg
C
38⅝" (36⅝" finished length)
Crosscut bottom end after laminating.
6" notches 1⅛" deep, 1/16" deep after jointing and planing
2⅞" (2¾" finished width)



5 Mark the threaded insert hole centers on the legs (A, B, C), where shown on **Drawing 2**. Then chuck a ⅜" brad-point bit into your drill press, and drill the holes.

6 Mark the centers of the ⅜" counterbores ¾" deep with ¼" holes centered inside and/or the centers of the ¼" holes on the legs (A, B, C), where shown on **Drawing 2**. Drill the counterbores and holes.

7 Finish-sand the legs (A, B, C). Then, using a 6mm hex wrench, drive the threaded inserts into the ⅜" holes.



Make the caps and coves

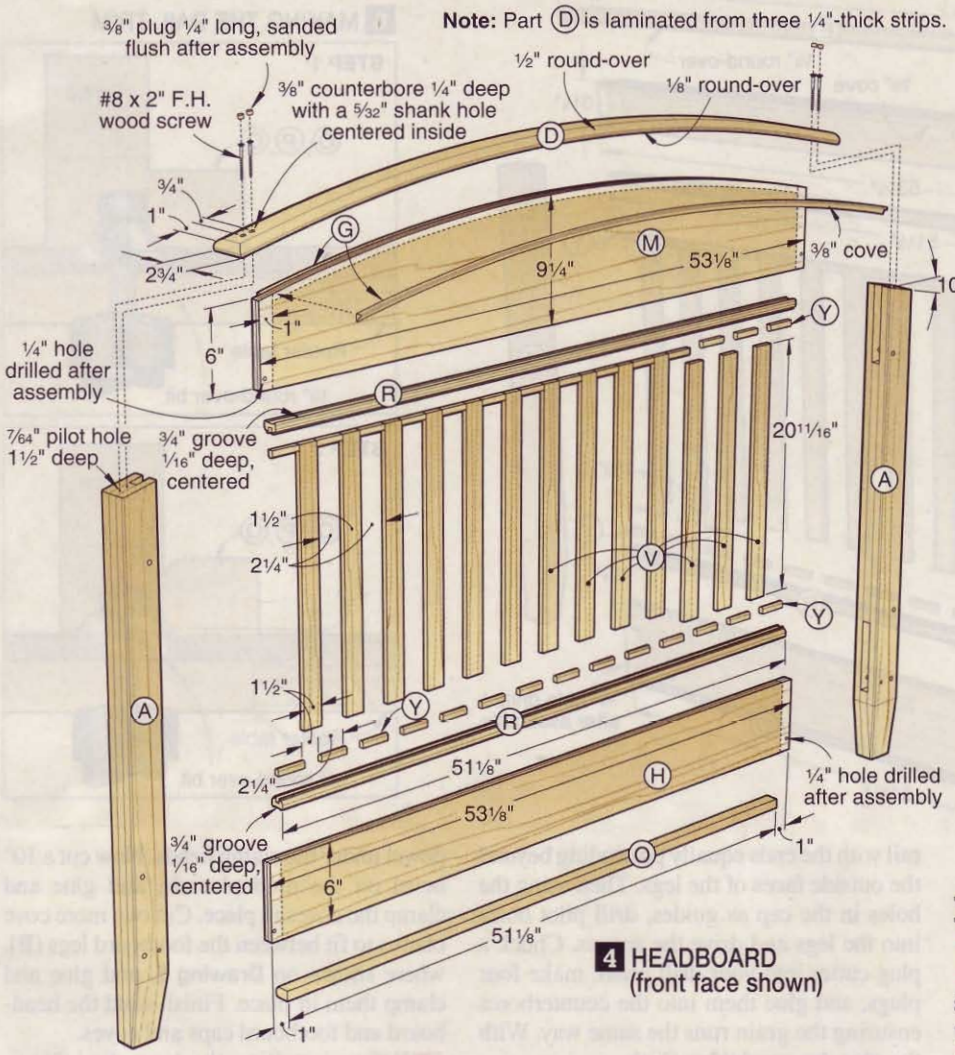
1 To make a form for the laminated headboard cap (D), cut four ¾x9¾x61⅛" pieces of particleboard. Then referring to **Drawing 3**, draw the top curve on one of the pieces, as shown in **Photo A**. Bandsaw and sand it to shape. Now using this piece as a pattern, trace the curve onto the remaining form pieces and bandsaw them, staying about ⅛" outside the lines. Clamp these pieces one at a time to the pattern, flush at the straight edge and ends, and trim them to shape with a handheld router and flush-trim bit. Finally, screw the four pieces together to create the form. Mark the centerline, lines for the ends of part M, and the cutlines for part D on the form.

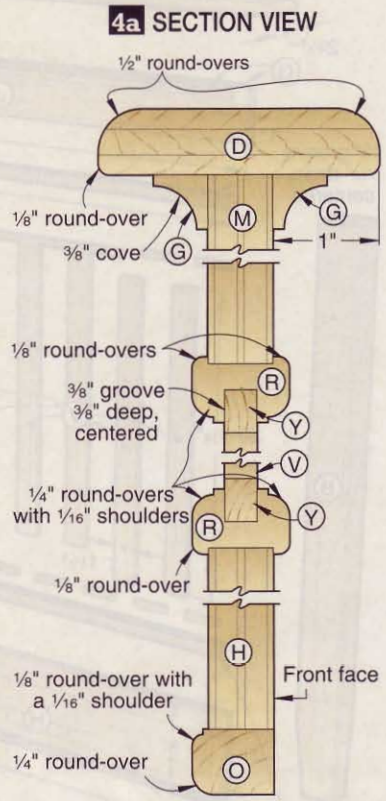
2 For the headboard cap (D), resaw and plane three ¼x2⅞x60" strips. Mark centerlines on the edges of the strips. Apply glue to the strips and then stack them, centered, on the form. Working from the center to the ends, clamp the strips to the form, keeping the edges flush.

3 Remove the headboard cap (D) from the form, and transfer the centerline from the edge to the bottom face. Scrape away excess glue, and joint one edge smooth. Then plane the cap to finished width. Now clamp the cap onto the form, aligning the centerlines. Transfer the cutlines from the form to the cap, remove the cap, and cut it to length. Cut the footboard cap (E) and end caps (F) to size.

Lay out the headboard cap (D) curve endpoints and midpoint, connect the points with a fairing stick, and draw the curve.

Double-face tape the rail (M) to the form between the rail-end lines and flush with the bottom edge. Flush-trim the rail to shape.





4 Mark ½" radii on the top ends of the headboard cap (D) and footboard cap (E), where shown on **Drawings 4** and **5**, and disc-sand them to shape. *Do not round the ends of the end caps (F).* Then chuck a ½" round-over bit into your table-mounted router. With the headboard cap on edge and the footboard and end caps facedown, rout the top edges, where shown on **Drawing 4a**.

5 Chuck a ⅛" round-over bit into a handheld router and rout the bottom ends of the headboard cap (D) and footboard cap (E). Switch the bit to your table-mounted router and with the headboard cap on edge and the footboard and end caps bottom down, rout the bottom edges.

6 Drill centered counterbored holes at the ends of the headboard cap (D), where dimensioned on **Drawing 4**. Finish-sand.

7 To make the cove blanks (G), plane a 6×60" board to ½" thick, and joint both edges. Chuck a ⅜" cove bit into your table-mounted router, and rout both edges. Then, on your tablesaw, rip ½"-wide strips from each edge. Now repeat the joint, rout, and rip steps until you have five cove blanks. Finish-sand the blanks.

Cut the rails and panels

1 From ¾" plywood, cut the lower rails (H), end lower rails (I), footboard upper rail (J), end upper rails (K), and bed rails (L) to size. Cut the headboard upper rail (M) ½" wider than the width listed.

2 Retrieve the headboard cap (D) bending form. Align the headboard upper rail (M) flush with the bottom edge of the form and between the rail-end lines. Trace the curve onto the rail, and bandsaw it, staying ⅛" outside the line. Now, using a handheld router and flush-trim bit, trim the rail to final shape, as shown in **Photo B**. Finish-sand all the rails.

3 Cut four ¼" plywood blanks 1" larger in length and width than the size listed for the end panels (N). Then, for laminating the panels, cut two ¾" particleboard cauls to the same size. Now glue the blanks together in pairs with the good faces out, place them between the cauls, and apply clamps. With the glue dry, remove the panels, and cut them to finished size, making sure they are square. Scrape off any glue squeeze-out, and finish-sand the panels.

Mill moldings and slats

1 Cut the lower rail trim (O), end lower rail trim (P), and bed rail trim (Q) to size. Then rout the parts, as shown in **Steps 1** and **2** of **Drawing 6**.

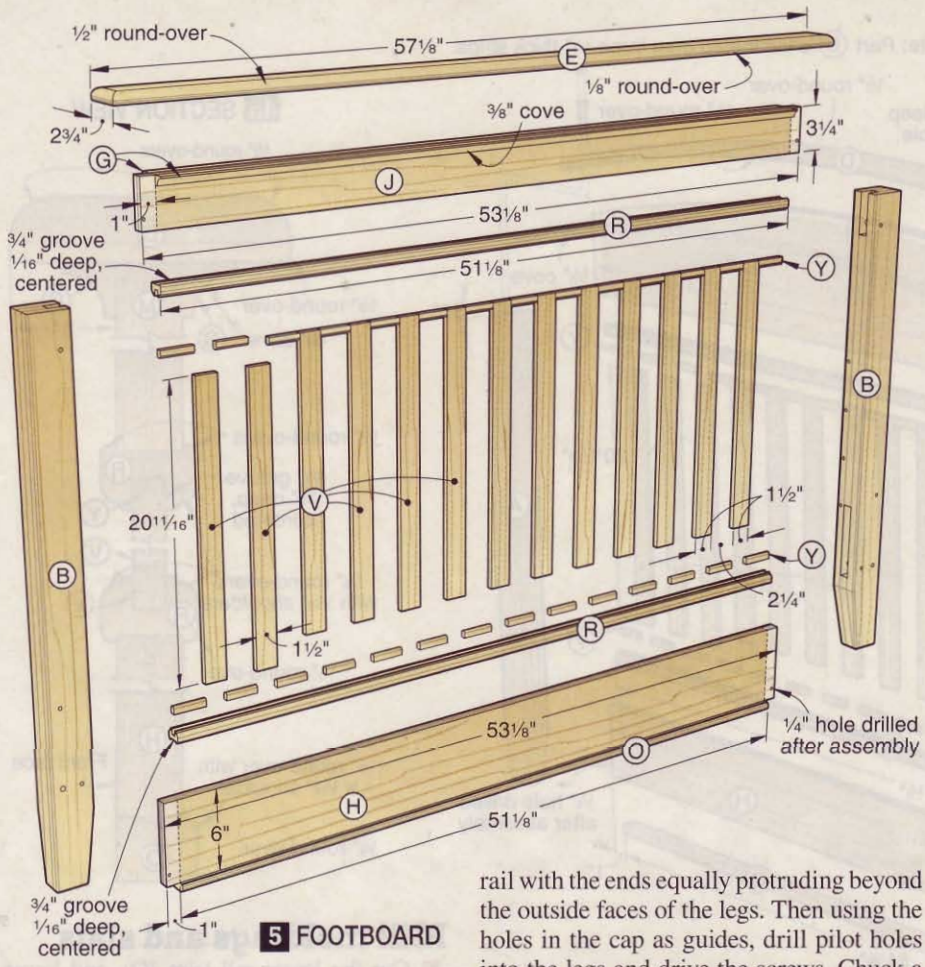
2 Cut the slat retainers (R), panel retainers (S), panel edging (T), and railing (U) to size. Then groove and rout the parts, as shown in **Steps 1–7** of **Drawing 7**.

3 Plane stock to ⅜" thick and test the fit in the slat retainer (R) grooves. Then cut the long slats (V), short slats (W), end slat (X), and slat spacer blanks (Y) to size. Plane stock to fit in the panel retainer (S) slots, and cut the panel spacer blank (Z) to size.

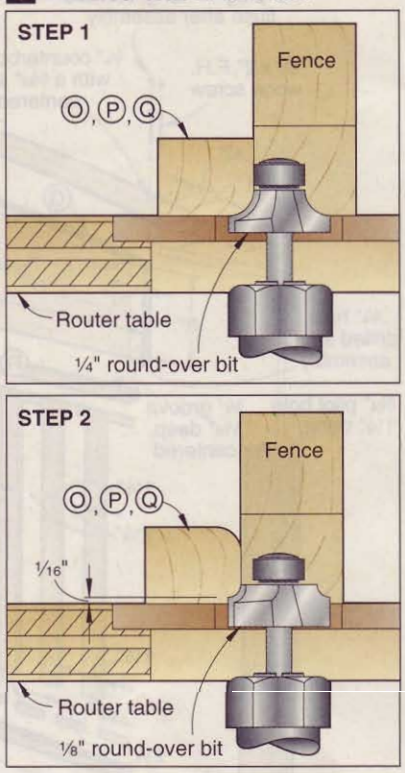
Assemble the headboard and footboard

1 Glue and clamp the lower rail trim (O) to the bottom edges of lower rails (H). Center the trim, forming 1"-long "tenons" at the rail ends, where shown on **Drawings 4**, **5**, and **8**. Keep the trim and rails flush on the inside faces, where shown on **Drawing 4a**.

2 Glue and clamp the slat retainers (R) to the top edges of the lower rails (H) and the bottom edges of the headboard upper rail (M) and footboard upper rail (J). Center the trim end to end, forming 1"-long tenons at the rail ends. Finish-sand the lower rail trim (O) and the slat retainers. Set one rail assembly (H/O/R) aside for the guardrail.



5 FOOTBOARD



3 Capturing the lower rail (H) tenons and headboard upper rail (M) tenons in the headboard leg (A) mortises, glue and clamp the rails and legs in the arrangement shown on **Drawing 4**. Then capturing the lower rail (H) tenons and footboard upper rail (J) tenons in the footboard leg (B) mortises, glue and clamp the rails and legs in the arrangement shown on **Drawing 5**. Check the assemblies for square. Then using the ¼" holes in the legs as guides, drill through the rail tenons.

4 Glue and clamp the headboard cap (D) to the headboard upper rail (M) and headboard legs (A). Center the cap on the rail with the ends equally protruding beyond the outside faces of the legs. Then using the holes in the cap as guides, drill pilot holes into the legs and drive the screws. Chuck a plug cutter into your drill press, make four plugs, and glue them into the counterbores ensuring the grain runs the same way. With the glue dry, sand them flush.

5 Glue and clamp the footboard cap (E) to the footboard upper rail (J) and footboard legs (B). Center the cap on the rail with the ends equally protruding beyond the outside faces of the legs.

6 To fit the coves along the bottom edges of the curved headboard cap (D), where shown on **Drawings 4** and **4a**, first cut a 10° bevel on one end of two cove blanks (G). Then dry-fit and mark each cove, as shown in **Photos C** and **D**. To apply clamping pressure to the cove, place short pieces of ¾" dowel under the clamp heads. Now cut a 10° bevel on the marked ends, and glue and clamp the coves in place. Cut two more cove blanks to fit between the footboard legs (B), where shown on **Drawing 5**, and glue and clamp them in place. Finish-sand the headboard and footboard caps and coves.

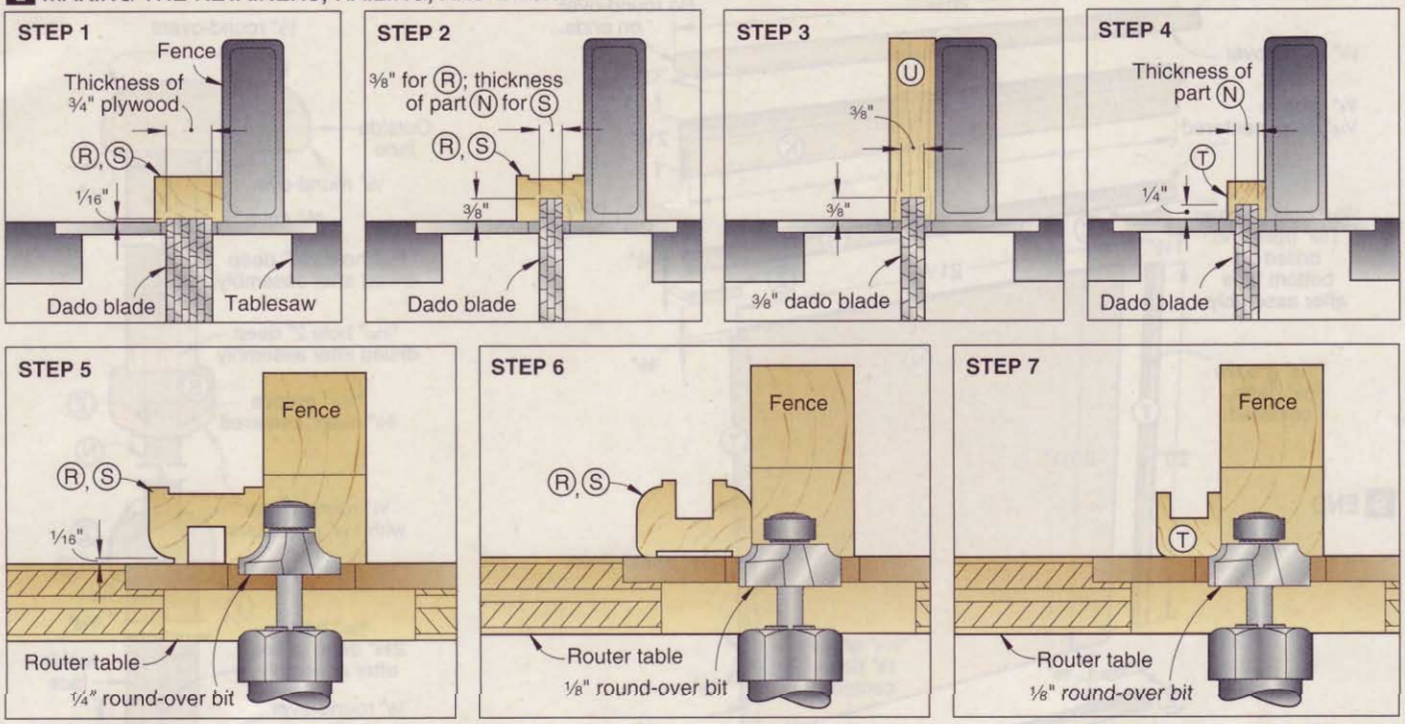
7 Before installing the long slats (V) in the headboard, make sure they are 1/16" shorter than the distance between the bottoms of the grooves in the upper and lower slat retainers (R). Then, on masking tape, mark centerlines on one slat at both ends and the centers of the slat retainers. Next, from the slat spacer blanks (Y), cut 28 slat spacers 2¼" long. Now, working from the center, install the spacers and slats, as shown in **Photo E**. Measure and cut the last four spacers to fit between the outer slats and the legs (A). Repeat with the footboard.

MARK THE HEADBOARD COVES

Place ⅜"-thick spacers under the cove (G), tightly fit the beveled end against one leg (A), and clamp the cove in place.

With the free end of the cove (G) overlapping the other leg (A), place a ruler against the leg and mark a cutline on the cove.

7 MAKING THE RETAINERS, RAILING, AND EDGING

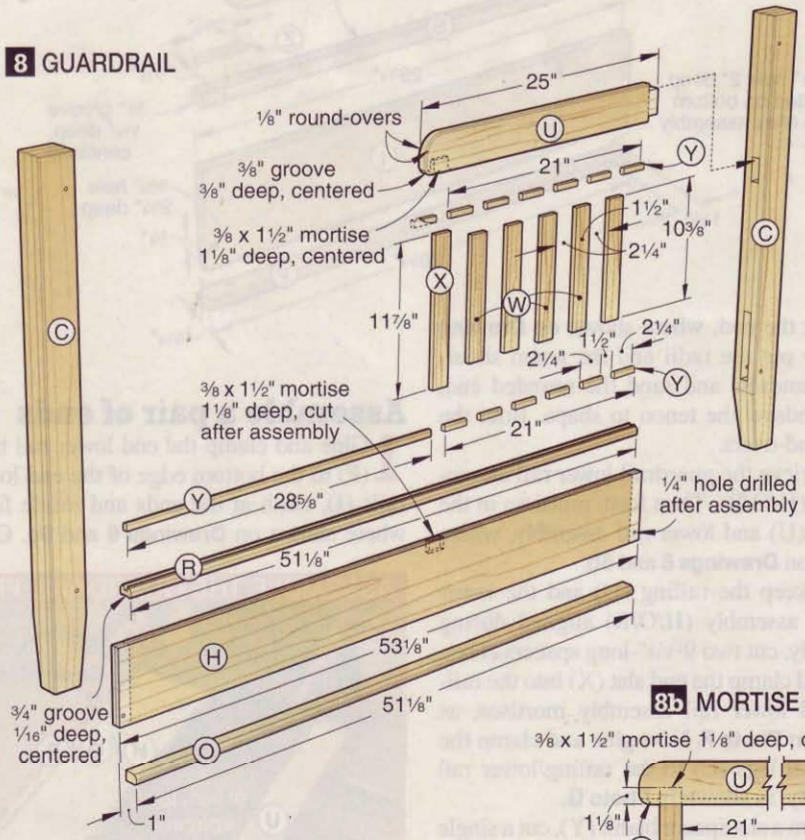


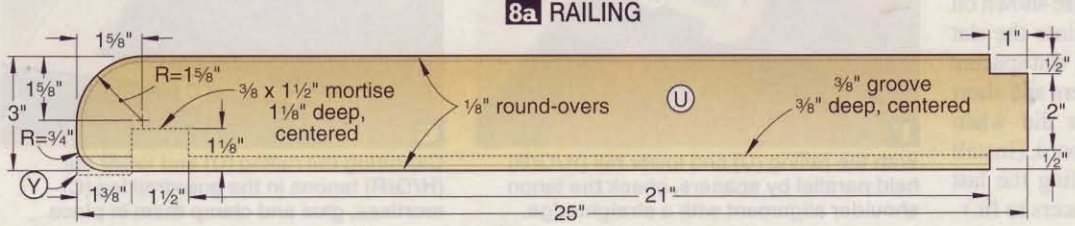
Note: *Because you'll run out of room to angle the slats into the retainer grooves, install the last two slats at the outside ends of the headboard and footboard before installing the last six spacers at each end.*

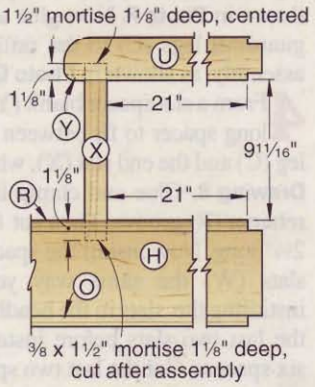
Assemble the guardrail

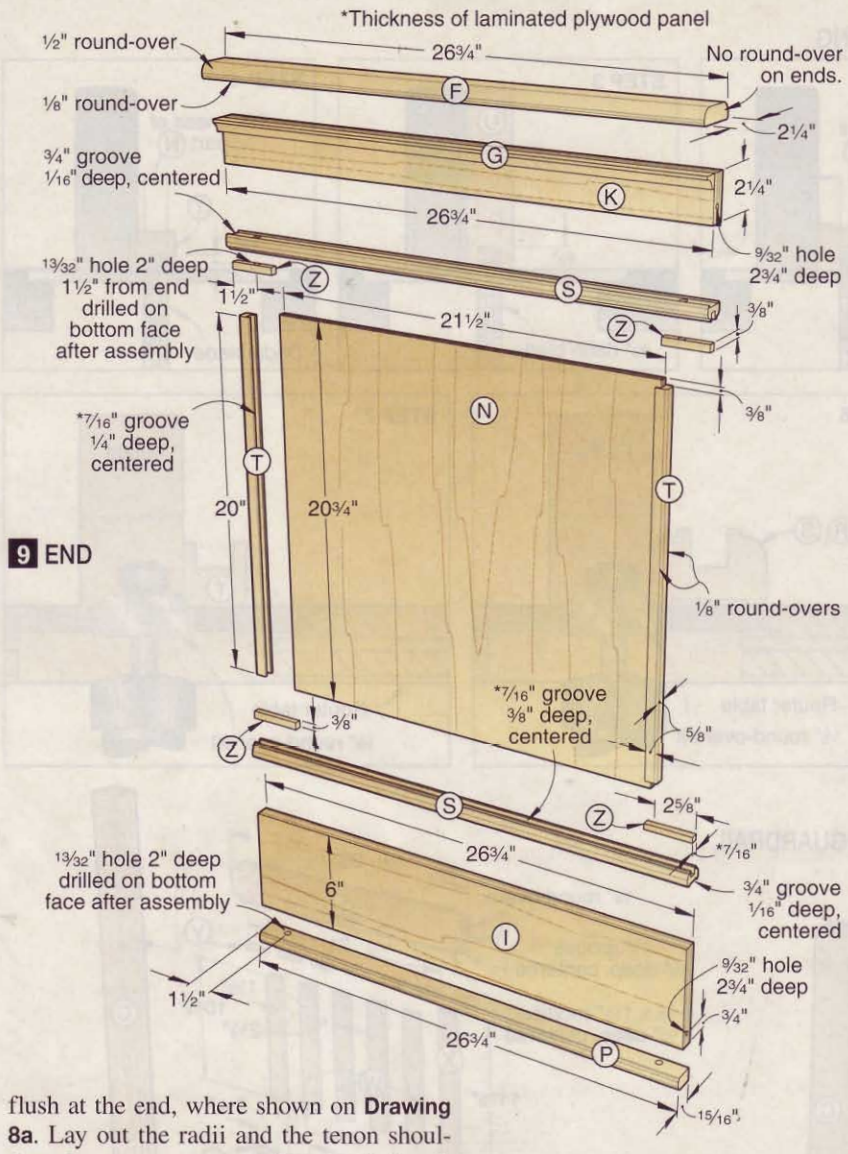
1 Retrieve the railing (U). From a slat spacer blank (Y), cut a 1⅜"-long slat spacer and glue it into the railing groove

With the slat (V) and retainer (R) centerlines aligned, install spacers (Y) and slats. Glue the spacers in place, but not the slats.

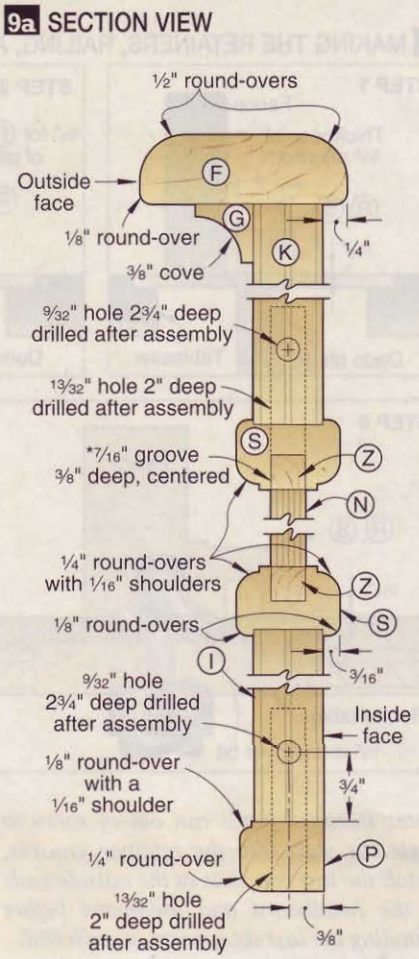








9 END



9a SECTION VIEW

flush at the end, where shown on **Drawing 8a**. Lay out the radii and the tenon shoulders. Bandsaw and sand the rounded end, and bandsaw the tenon to shape. Rout the ⅛" round-overs.

2 Retrieve the guardrail lower rail assembly (H/O/R). Then form mortises in the railing (U) and lower rail assembly, where shown on **Drawings 8** and **8b**.

3 To keep the railing (U) and the lower rail assembly (H/O/R) aligned during assembly, cut two 9 11/16"-long spacers. Then glue and clamp the end slat (X) into the railing and lower rail assembly mortises, as shown in **Photo F**. Now glue and clamp the guardrail legs (C) to the railing/lower rail assembly, as shown in **Photo G**.

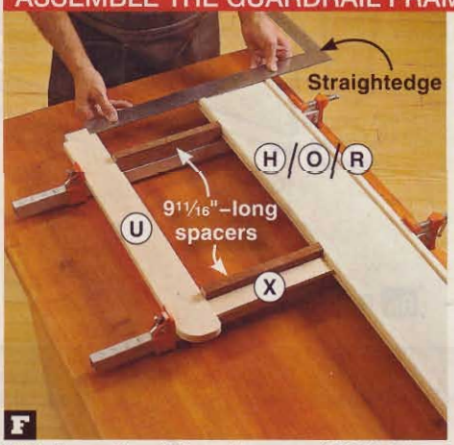
4 From a slat spacer blank (Y), cut a single long spacer to fit between the guardrail leg (C) and the end slat (X), where shown on **Drawing 8**. Glue and clamp it into the slat retainer (R) groove. Then cut 11 slat spacers 2¼" long. Now install the spacers and short slats (W) the same way you did when installing the slats in the headboard. (Install the last two slats before installing the last six spacers. Cut the last two spacers to fit.)

Assemble a pair of ends

1 Glue and clamp the end lower rail trim (P) to the bottom edge of the end lower rails (I), flush at the ends and inside face, where shown on **Drawings 9** and **9a**. Glue and clamp the panel retainers (S) to the top edges of the lower rails and the bottom edges of the end upper rails (K).

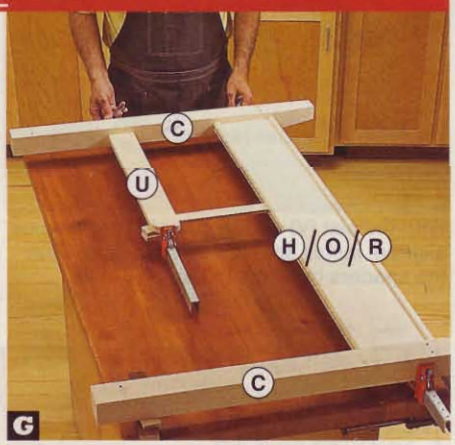
2 From the panel spacer blank (Z), cut eight spacers 2⅝" long, and glue and clamp them into the panel retainer (S) grooves, flush with the ends. Then chuck a 13/32" brad-point bit into your drill press, and drill cross-dowel holes in the bottom edges of the lower and upper rail assemblies (I/P/S/Z, K/S/Z), where dimensioned on **Drawings 9** and **9a**.

ASSEMBLE THE GUARDRAIL FRAME



F

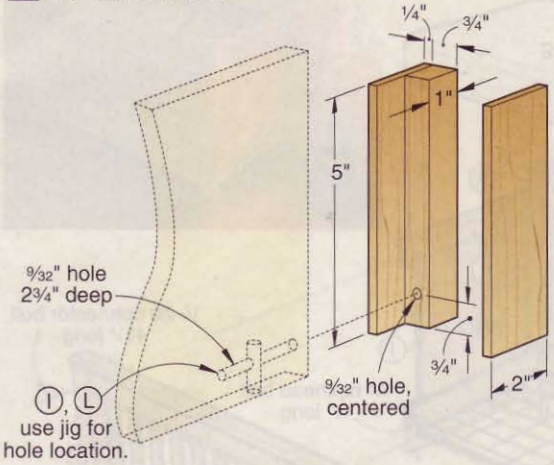
With the railing (U) and lower rail (H/O/R) held parallel by spacers, check the tenon shoulder alignment with a straightedge.



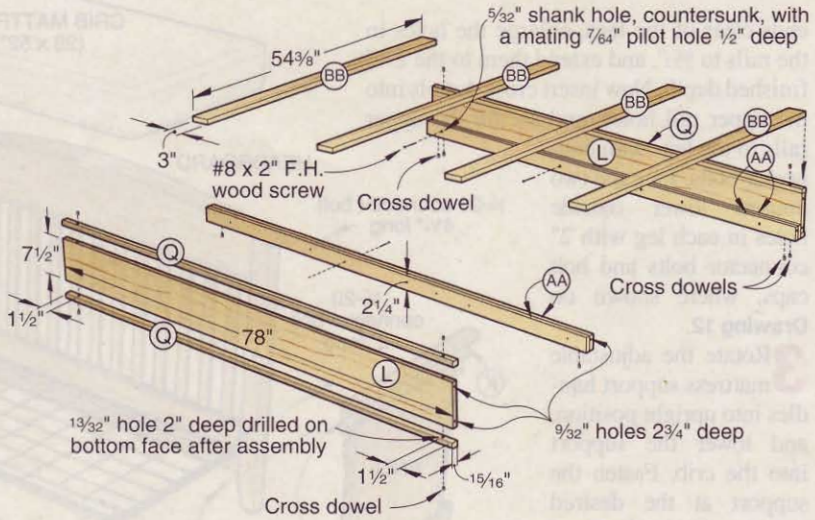
G

Capturing the railing (U) and lower rail (H/O/R) tenons in the guardrail leg (C) mortises, glue and clamp them in place.

10 DRILLING GUIDE



11 BED RAIL ASSEMBLY



3 Glue and clamp the end caps (F) to the end upper rails (K), flush at the ends and offset as dimensioned on **Drawing 9a**. Then, from a cove blank (G), cut two coves to the same length as the end upper rails, and glue and clamp them in place. Finish-sand the end lower and upper rail assemblies.

4 Glue and clamp the panel edging (T) to the end panels (N). Center the trim top to bottom, where shown on **Drawing 9**. Finish-sand the edging. Now assemble the ends, as shown in **Photo H**.

5 To drill 9/32" connector-bolt holes that intersect the cross-dowel holes in the end lower rails (I), first build the drilling guide shown on **Drawing 10**. Then drill holes in both ends of the rails, as shown in **Photo I**. The connector-bolt holes in the end upper rails (K) will be drilled later.

Assemble the bed rails

1 Glue and clamp the bed rail trim (Q) to the bed rails (L), flush at the ends and inside faces, where shown on **Drawings 11** and **11a**. Then chuck a 13/32" brad-point drill bit into your drill press, and drill cross-dowel holes in the top and bottom edges at both ends, where dimensioned.

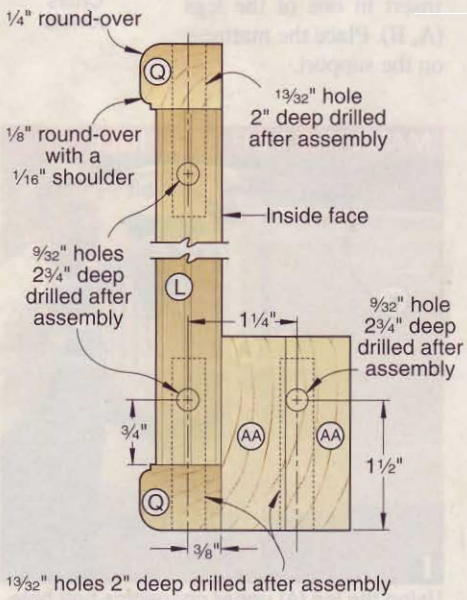
2 Clamp the drilling guide to the ends of the bed rails (L) with the bottom edge of the guide against the top edge of the lower bed rail trim (Q). Then drill connector-bolt holes in the ends of the bed rails. The upper holes will be drilled later.

3 Cut the cleats (AA) and cross rails (BB) to size. Glue and clamp the cleats to the bed rails, flush at the bottom, where shown on **Drawings 11** and **11a**. Then drill screw holes where shown, and drive the screws. Now drill 13/32" cross-dowel holes into the cleats. Finish-sand the bed rail trim (Q), cleats, and cross rails.

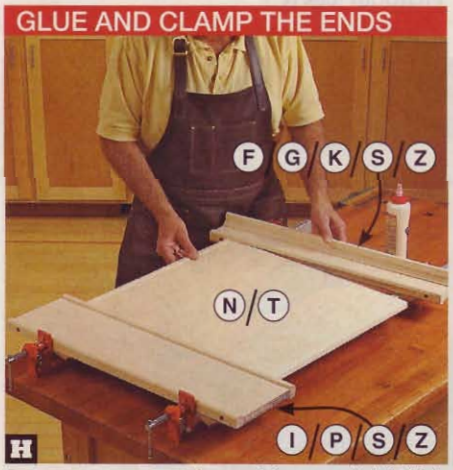
Apply the finish

Examine all the parts, and finish-sand where needed. Apply two coats of clear finish. (We applied two coats of water-based polyurethane, sanding with 220-grit sandpaper between coats.)

11a BED RAIL ASSEMBLY END VIEW



GLUE AND CLAMP THE ENDS



Squeeze glue into the end lower rail (I/P/S/Z) and end upper rail (F/G/K/S/Z) grooves, and clamp the panel (N/T) in place.

DRILL CONNECTOR BOLT HOLES

With the drilling guide against the lower rail trim (P) and clamped to the lower rail (I), drill a 9/32" hole 2 3/4" deep.

Assemble the crib

1 To assemble the crib, insert cross dowels into the holes in the bottom edges of the end lower rails (I), where shown on **Drawing 12**. Slide 4 3/4"-long connector bolts through the bottom *outside* holes in the headboard legs (A) and footboard legs (B), into the holes in the ends of the end lower rails, and thread them into the cross dowels, where shown on **Drawing 12a**. To hold the cross dowels in place during assembly, see the **Shop Tip** on *page 52*.

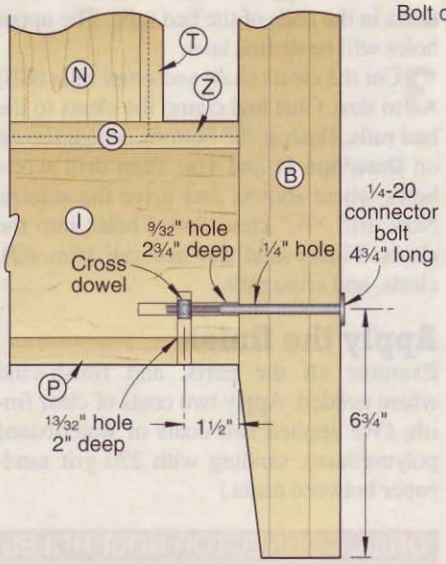
2 Align the ends so the bottom and top rails (I, K) are parallel to the edges of the legs (A, B), and clamp them in place. Mark the locations of the upper connector-bolt holes on the ends of the end upper rails (K), as shown in **Photo J**. Then pivot the

ends clear of the legs, enlarge the holes in the rails to 9/32", and extend them to the 2¾" finished depth. Now insert cross dowels into the upper rail holes, and secure the upper rails to the legs with connector bolts. Plug the two unused lower outside holes in each leg with 2" connector bolts and bolt caps, where shown on **Drawing 12**.

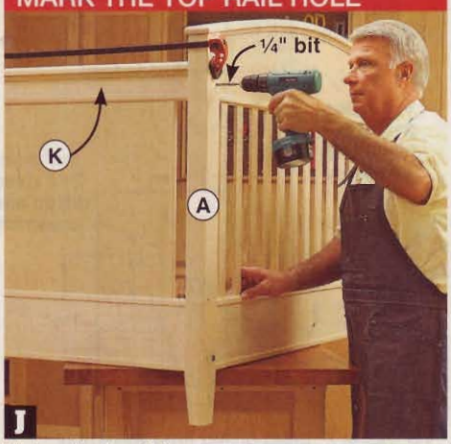
3 Rotate the adjustable mattress support handles into upright position, and lower the support into the crib. Fasten the support at the desired height with a hexhead bolt inserted through the hole in each handle and threaded into the threaded insert in one of the legs (A, B). Place the mattress on the support.

12 CRIB

12a CONNECTOR BOLT DETAIL



MARK THE TOP RAIL HOLE



Using the leg (A) upper connector-bolt hole as a guide, mark the hole location on the end upper rail (K) with a ¼" drill bit.

From crib to toddler bed

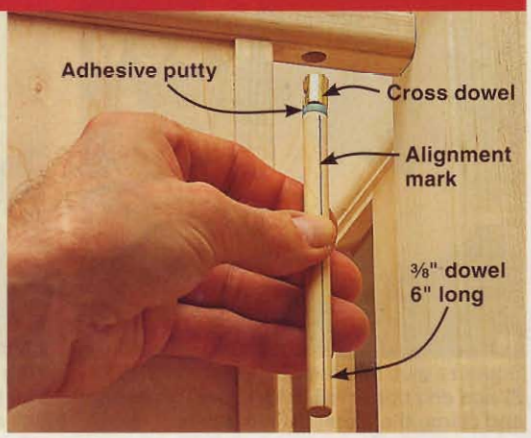
Remove the crib mattress and the mattress support bolts from the footboard threaded inserts. Then remove the connector bolts that fasten the footboard to the ends. Retrieve the guardrail and fasten it to the ends with connector bolts and cross dowels, where shown on **Drawing 13**. If necessary, relocate the mattress support to the lowest position, and bolt it to the headboard legs (A) and guardrail legs (C).

SHOP TIP

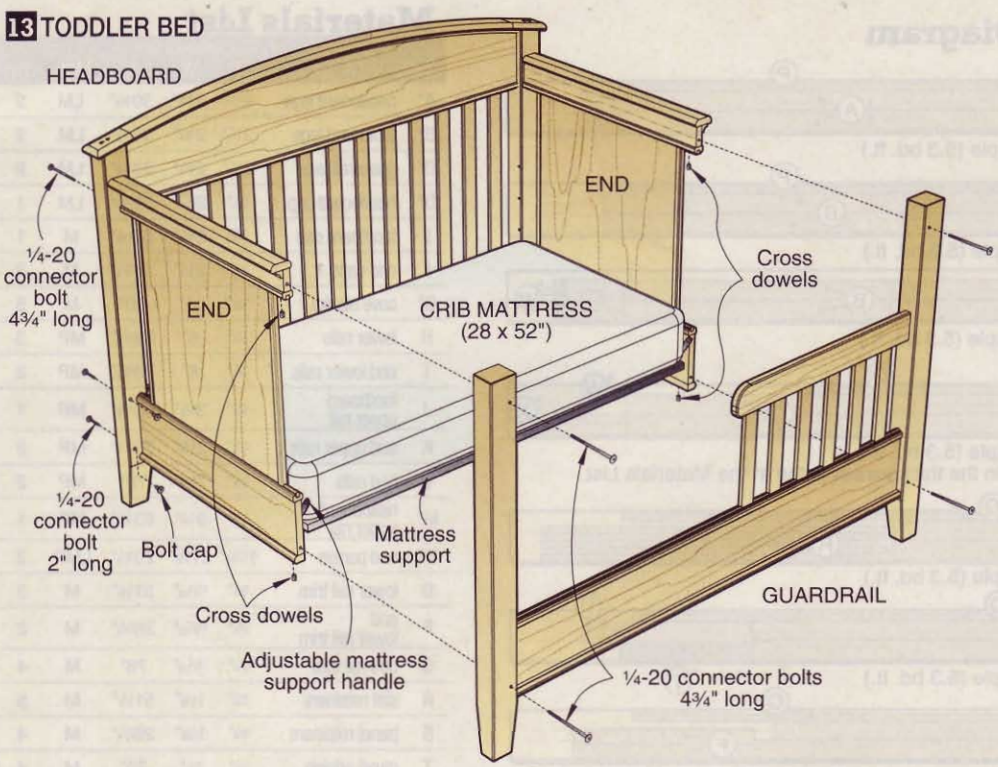
A sticky solution for positioning the cross dowels

When installing cross dowels, using a screwdriver to align them with a connector bolt can be downright frustrating. And that's just when inserting them from the bottom. When inserted from the top, a screwdriver can't lift the cross dowel off the bottom of the hole. Here's a hassle-free way to position the cross dowels when joining the headboard, footboard, and guardrail to the end rails and bed rails with connector bolts.

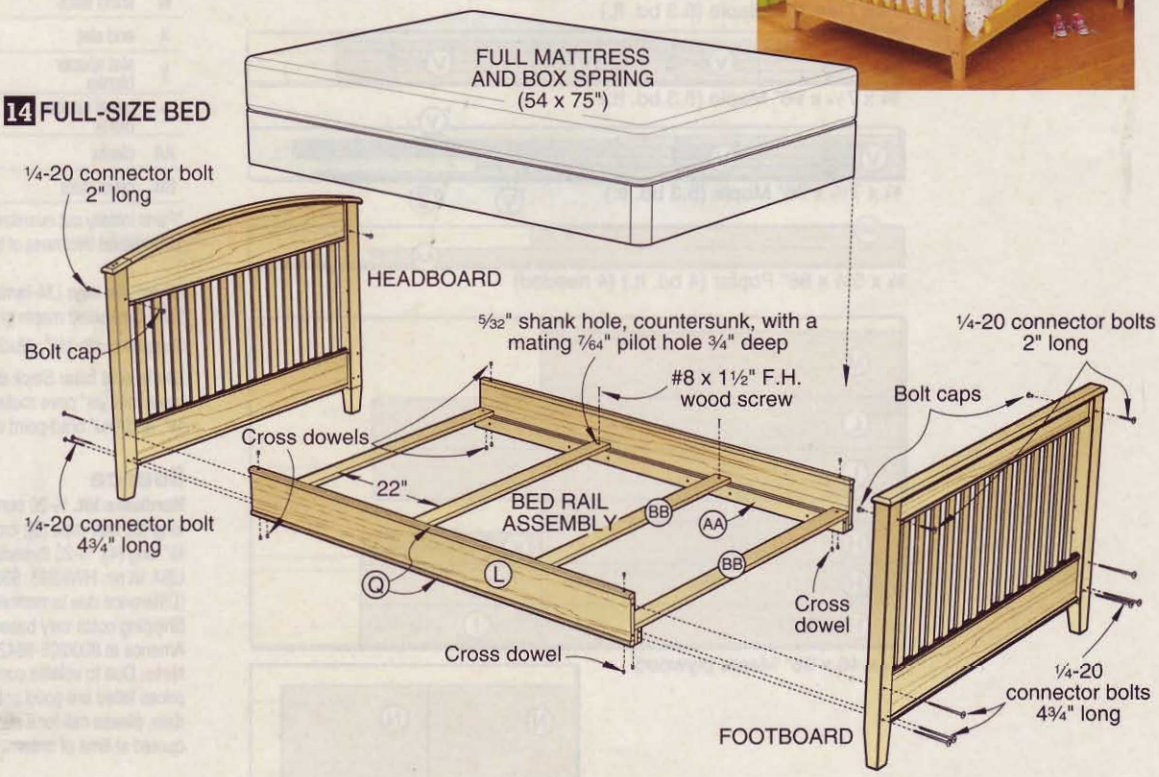
Cut a 6"-long piece of 3/8" dowel, and draw a straight line along the length. Then adhere a small ball of adhesive putty (such as Sticky Tack or Tac'N Stick) to one end, and press the cross dowel into it. Orient the cross dowel so the line on the dowel faces out when the cross-dowel hole aligns with the connector-bolt hole, as shown at *right*. Now, when you insert the cross dowel into the rail, this temporary handle makes it easy to align the threaded hole in the cross dowel with the connector bolt.



13 TODDLER BED



14 FULL-SIZE BED



From toddler to full bed

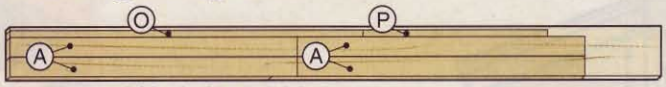
1 Remove the crib mattress. Unbolt and remove the mattress support. Then remove the connector bolts and cross dowels that hold the guardrail to the ends and the ends to the headboard. Retrieve the bed rails (L/Q) and footboard. Now insert cross dowels into the bottom holes in the bed rails and fasten them to the headboard and footboard with connector bolts inserted through the lower outside holes in the legs, where shown on **Drawing 14**.

2 Align the bed rails (L/Q) so they are parallel to the edges of the legs, and clamp them in place. Then using the leg holes adjacent to and above the connector bolts as guides, drill ¼" holes into the cleats (AA) and bed rails (L). Disassemble the rails, headboard, and footboard. Enlarge the rail holes to 9⁄32" and extend them to the 2¾" finished depth. Now reassemble the parts with connector bolts and cross dowels. Plug the unused holes in the legs with connector bolts and bolt caps.

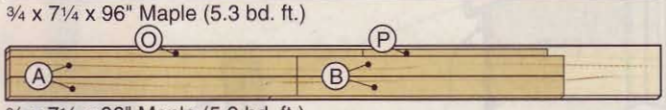
3 Clamp the cross rails (BB) to the cleats (AA), where dimensioned on **Drawing 14**. Then drill screw holes through the cross rails and into the cleats, and drive the screws. Place a full box spring and mattress on the cross rails. Now take a few minutes to test the mattress for comfort. You've earned it.

Written by **Jan Svec** with **Chuck Hedlund**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

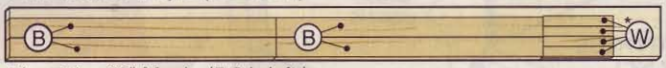
Cutting Diagram



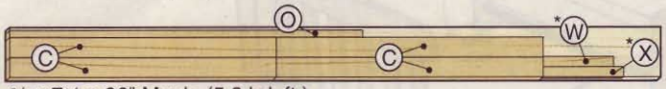
¾ x 7¼ x 96" Maple (5.3 bd. ft.)



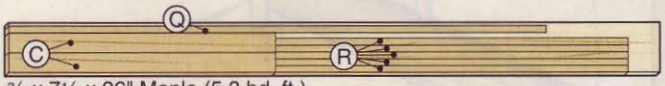
¾ x 7¼ x 96" Maple (5.3 bd. ft.)



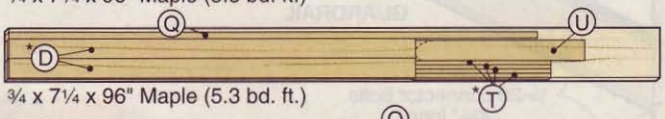
¾ x 7¼ x 96" Maple (5.3 bd. ft.)



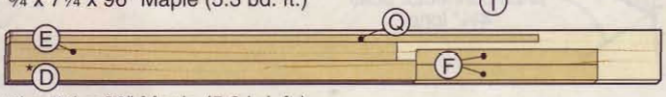
¾ x 7¼ x 96" Maple (5.3 bd. ft.)
*Plane or resaw to the thicknesses listed in the Materials List.



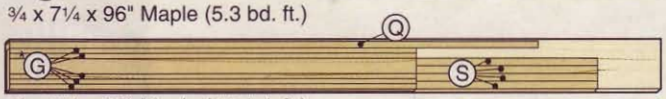
¾ x 7¼ x 96" Maple (5.3 bd. ft.)



¾ x 7¼ x 96" Maple (5.3 bd. ft.)



¾ x 7¼ x 96" Maple (5.3 bd. ft.)



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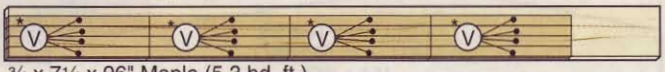

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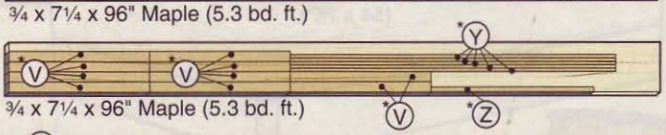

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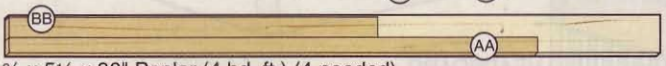
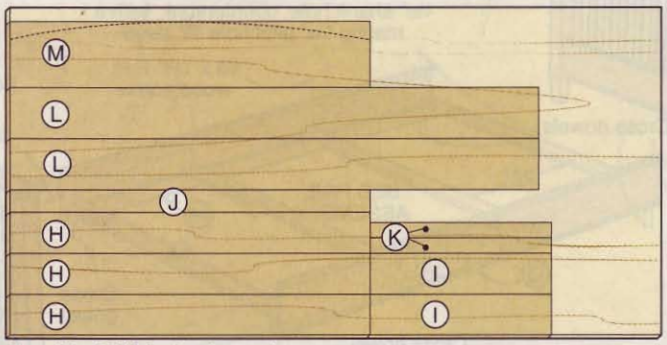
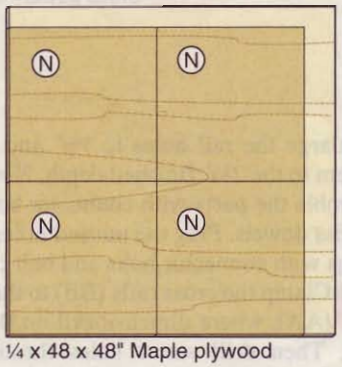


¾ x 5½ x 96" Poplar (4 bd. ft.) (4 needed)



¾ x 48 x 96" Maple plywood



¼ x 48 x 48" Maple plywood

Materials List

Parts		FINISHED SIZE T	W	L	Matl.	Qty.
A*	headboard legs	2¼"	2¾"	39⅝"	LM	2
B*	footboard legs	2¼"	2¾"	36⅝"	LM	2
C*	guardrail legs	2¼"	2¾"	36⅝"	LM	2
D*	headboard cap	¾"	2¾"	58⅛"	LM	1
E	footboard cap	¾"	2¾"	57⅛"	M	1
F	end caps	¾"	2¼"	26¾"	M	2
G*	cove blanks	½"	½"	60"	M	5
H	lower rails	¾"	6"	53⅛"	MP	3
I	end lower rails	¾"	6"	26¾"	MP	2
J	footboard upper rail	¾"	3¼"	53⅛"	MP	1
K	end upper rails	¾"	2¼"	26¾"	MP	2
L	bed rails	¾"	7½"	78"	MP	2
M*	headboard upper rail	¾"	9¼"	53⅛"	MP	1
N*	end panels	†7/16"	21½"	20¾"	LMP	2
O	lower rail trim	¾"	15/16"	51⅛"	M	3
P	end lower rail trim	¾"	15/16"	26¾"	M	2
Q	bed rail trim	¾"	15/16"	78"	M	4
R	slat retainers	¾"	1⅛"	51⅛"	M	5
S	panel retainers	¾"	1⅛"	26¾"	M	4
T	panel edging	⅝"	⅝"	20"	M	4
U	railing	¾"	3"	25"	M	1
V	long slats	⅜"	1½"	20 11/16"	M	26
W	short slats	⅜"	1½"	10⅜"	M	5
X	end slat	⅜"	1½"	11⅞"	M	1
Y	slat spacer blanks	⅜"	½"	48"	M	5
Z	panel spacer blank	⅜"	†7/16"	24"	M	1
AA	cleats	¾"	2¼"	78"	P	4
BB	cross rails	¾"	3"	54⅜"	P	4

*Parts initially cut oversize. See the instructions.
†Combined thickness of two pieces of ¼" plywood.

Materials key: LM–laminated maple, MP–maple plywood, LMP–laminated maple plywood, M–maple, P–poplar.

Supplies: #8x1½", #8x2" flathead wood screws.

Blade and bits: Stack dado set; ⅛", ¼", and ½" round-over router bits; ⅜" cove router bit; flush-trim router bit; ¼", 9/32", ⅜", and 13/32" brad-point drill bits; ⅜" plug cutter.

Source

Hardware kit. ¼-20 connector bolts 4¾" long (12), and 2" long (8); bolt caps (8); cross dowels (8); ¼" hexhead bolts ½" long (4); ¼-20 threaded inserts (18); mattress support. USA kit no. HWK895, $38; Canada kit no. HWK895C, $49. (Difference due to mattress support code requirements.) Shipping costs vary based on your location. Call Products America at 800/205-9642, or go to productsamerica.com.
Note: Due to volatile commodity prices and shipping costs, prices listed are good until December 31, 2006. After this date, please call for a current price. Shipping charge will be quoted at time of order.

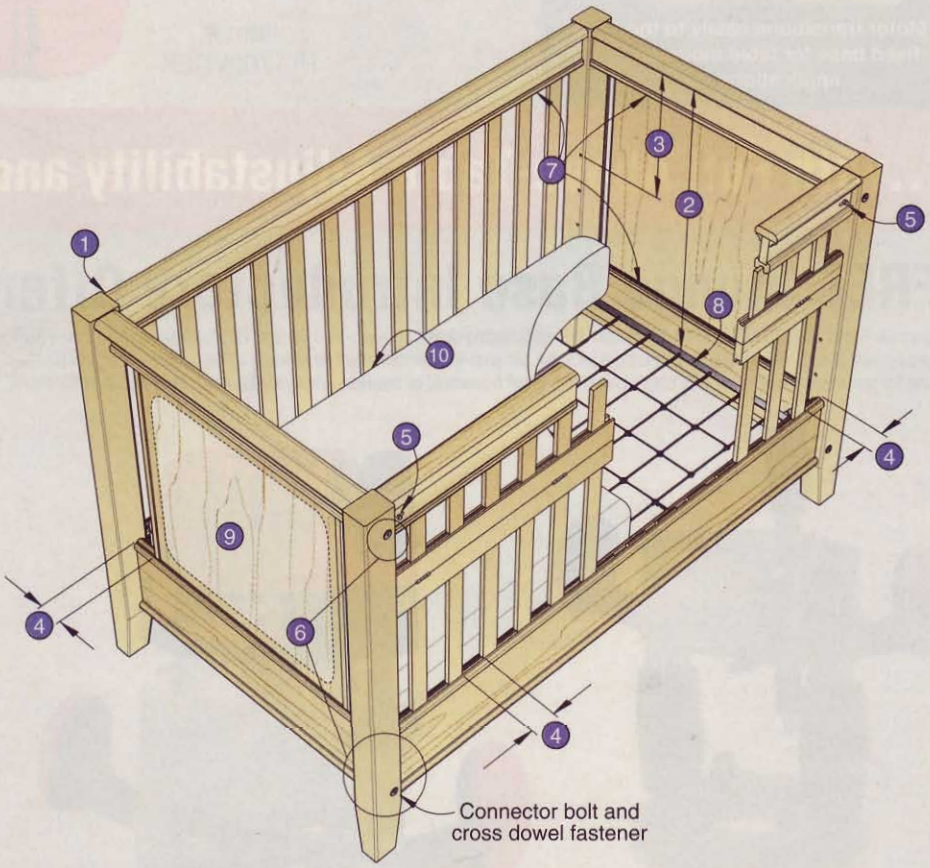
Find more
plans at our index to past articles
woodmagazine.com/index

full-size baby crib safety

A crib is a wonderful gift. Here are 10 features that make it a safe one.

Before you design your own baby crib, modify an existing plan, or even go shopping for one, make sure you know the requirements. The U.S. Consumer Products Safety Commission defines a full-size baby crib as a bed with interior dimensions of 52(±⅝)×28(±⅝)" designed to provide a place to sleep for an infant in or around the home. For a look at the full-size baby crib requirements, go to the CPSC Web site at cpsc.gov. Type "16 C.F.R. Part 1508" in the search window. Click on "Regulatory Summary Full Size Cribs." You'll need the free Adobe Reader to view the document.

To make it easier to understand these standards, we've distilled 10 key points:



1. Corner post extensions above a top rail must be less than 1/16" or greater than 16".
2. The tops of fixed upper rails or adjustable rails at the highest position must be at least 26" above the top of the mattress support in the lowest position.
3. The tops of fixed upper rails or adjustable rails at the lowest position must be at least 9" above the mattress support at the highest position.
4. The space between adjacent parts, such as slats, spindles, corner posts, and rods, must not exceed 2⅜".
5. Locking devices for adjustable rails require two distinct actions or a minimum of 10 pounds of force for release.
6. Wood screws may not be used to connect any parts that must be removed during normal disassembly.
7. To eliminate toeholds for climbing, horizontal projections inside the crib less than 20" above the mattress support in the lowest position may not exceed ⅜".
8. There must be no gap between the bottom of lower end and side rails and the top surface of the mattress support.
9. Because decorative cutouts in crib panels create the risk of head or neck entrapment, they should be eliminated from a crib's design.
10. The crib mattress must fit snugly, with no visible gap within the crib sides to prevent any entrapment of body parts.

Written by **Jan Svec** with **Jeff Mertz**
Illustration: **Roxanne LeMoine**

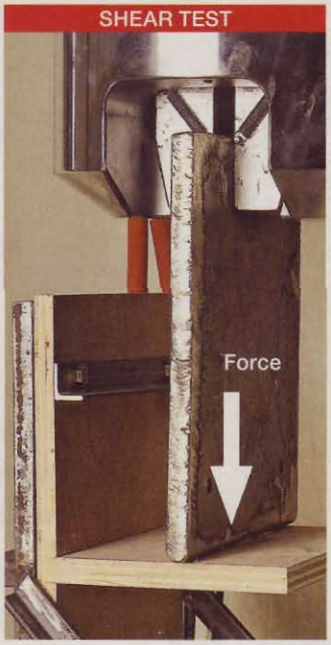
wood joint TORTURE TEST

Ever wonder if pocket-hole screws out-hold biscuits? Or if deeper dadoes yield stronger joints? We destroyed nearly 100 joints to discover these and other joinery secrets.

Once projects leave your shop, you can't predict their fate. Kids may climb on them. Maybe they'll endure a rough-and-tumble cross-country ride in the back of a bouncing truck, or groan from being overstuffed with books for decades. Building projects with extra-strong joints isn't just good craftsmanship, it's a commonsense precaution.

To discover what holds up best, we made samples of joints commonly used in *WOOD*® magazine projects: rabbets and dadoes; mortise-and-tenons; butt joints; and miters made with and without reinforcements such as screws, biscuits, dowels, and pocket-hole screws. Then we took them to Iowa State University's Structural Materials Testing Facility, home to a materials testing machine that can apply thousands of pounds of force while measuring that force to within ±1 pound.

There, we tested each joint for two kinds of strength: the ability to resist being pulled apart and "shear strength,"



the ability to resist being pushed out of 90° angles. Some joints met a quick and quiet end after just a hint of force; others failed only after long, loud crackles as their fibers were ripped in half from tons of force. (Watch a free video of the joints breaking at woodmagazine.com/jointtest.)

After testing three samples of each joint, we averaged the results, analyzed the damage for weaknesses, and uncovered a few surprises, such as the 2½-ton pull-apart strength of some mortise-and-tenon joints.

Don't mistake a low score for a weak joint, though. Even unreinforced miters can hold a picture frame together under normal, stress-free use for as long as the strongest mortise-and-tenon joint. But when the going gets rough, our tests show which joints will help your projects survive to become heirlooms.

Now, it's crunch time.

Dadoes and rabbets

Here's what we tested: Using ¾" birch plywood, we measured pull-apart and shear strengths of ¼" and ⅜" dadoes, plus ⅜"-deep dadoes with three 1½" screws. Then we compared ½"-deep rabbets in 11½"-wide samples with three versus six screws.

Test findings and lessons

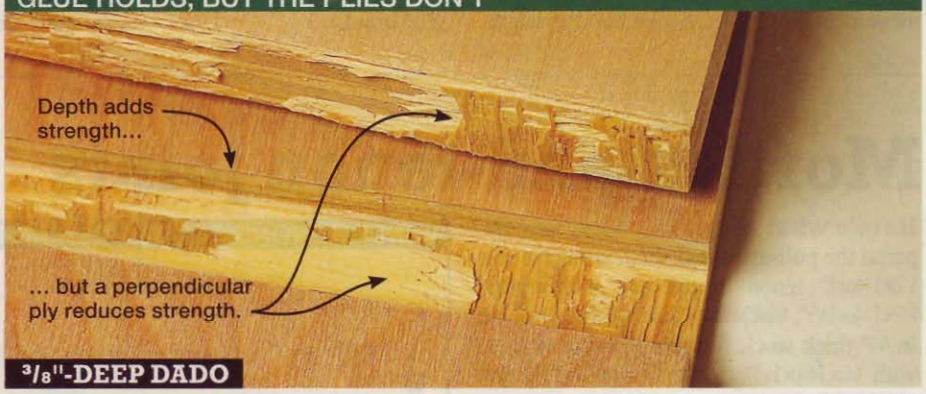
■ **FINDING:** Dado pull-apart strength has less to do with depth than the orientation of the ply at the dado bottom. The ⅜" dadoes averaged 17 percent less pull-apart strength than ¼" dadoes. **LESSON:** To strengthen dadoes, cut to the center of a ply that runs parallel with the surface grain.

■ **FINDING:** Deepening dadoes from ¼" to ⅜" increased sheer strength 37 percent. **LESSON:** Increasing dado depth adds greater mechanical ability to resist shear stress, especially when cut to a ply running parallel with the surface grain.

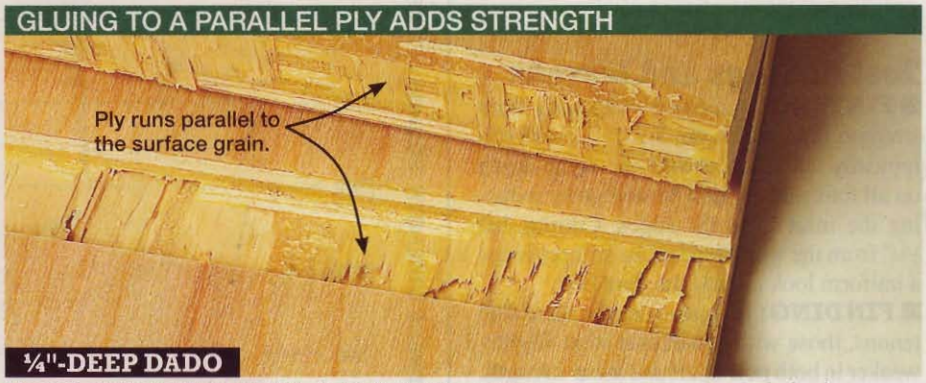
■ **FINDING:** Few pull-apart test samples showed a strong bond between the plywood faces and the dado sides as shown at *right*. **LESSON:** Avoid squeeze-out by minimizing glue on the sides of a dado.

■ **FINDING:** Screwing through joints adds little to the shear strength of ⅜"-deep dadoes. **LESSON:** Screws still keep the joint from failing completely should it crack.

GLUE HOLDS, BUT THE PLIES DON'T

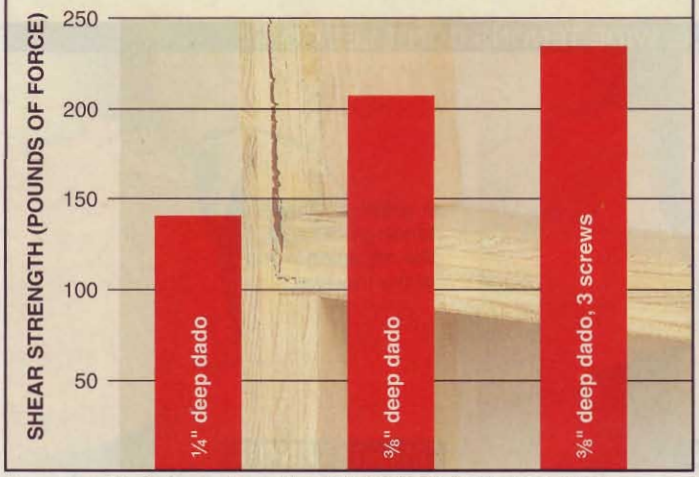


GLUING TO A PARALLEL PLY ADDS STRENGTH



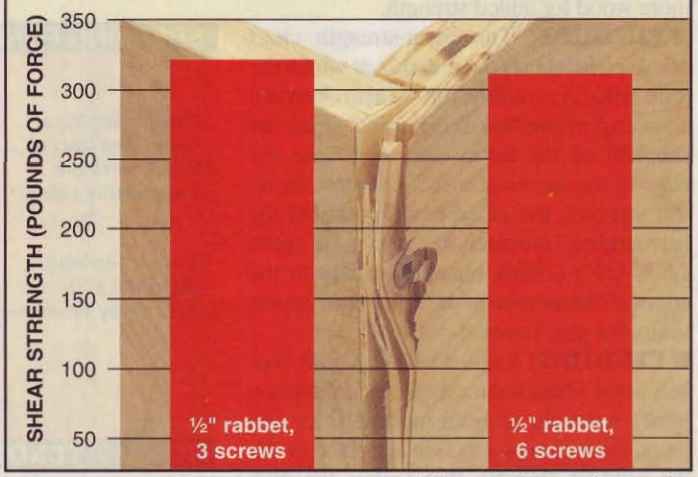
Though shallower than the ⅜"-deep dado shown at the *top*, the ¼"-deep dado had more pull-apart strength because it connected with a ply running parallel to the surface grain. The bottom of the deeper dado rested on a ply running perpendicular to the grain. However, the higher sides of the ⅜"-deep dado increased its shear strength.

SCREWS HELP REINFORCE JOINTS...



Screws added sheer strength to ⅜" dadoes, but not as much as making the dado 50 percent deeper.

...BUT MORE AREN'T BETTER

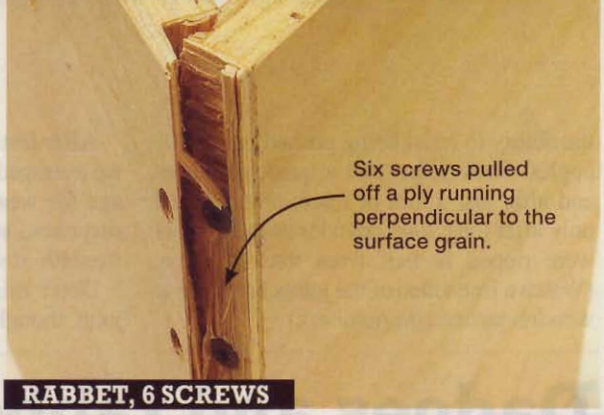


Doubling the number of screws weakened the wood enough to make the joint slightly easier to break.

■ **FINDING:** Some dadoes withstood more than 1,100 pounds of pull-apart force, but failed with just 140 pounds of shearing force. **LESSON:** Bookcase back panels relieve shear stress.

■ **FINDING:** Yellow glue outlasted the surrounding wood—occasionally even on end grain—but it's not made to fill gaps. **LESSON:** Fit joints as tightly as you can by hand to add mechanical resistance to movement and increase glue bond strength.

■ **FINDING:** Doubling the number of screws from three at 4¼" apart to six at 1⅝" actually weakened rabbet joints, as shown at *right*. **LESSON:** "More" doesn't always equal "better" when only a couple of plies remain beneath the rabbet. This joint's real strength lies in its glue bond.



Doubling the number of screws reduced the shear strength of a ½"-deep rabbet in ¾" plywood, including this sample. In pull-apart tests, the strength of a rabbet with six screws averaged only slightly higher than samples with three.

Mortise-and-tenon joints

Here's what we tested: First, we compared the pull-apart and shear strengths of a ¼×1¾×1" tenon in red oak with tenons ¼×1¾×1½", ¼×2¾×1", and ¼×2¾×1½", all in ¾"-thick stock. We also compared these with ¼×1¾×1½" tenons reinforced by two ⅜" dowels.

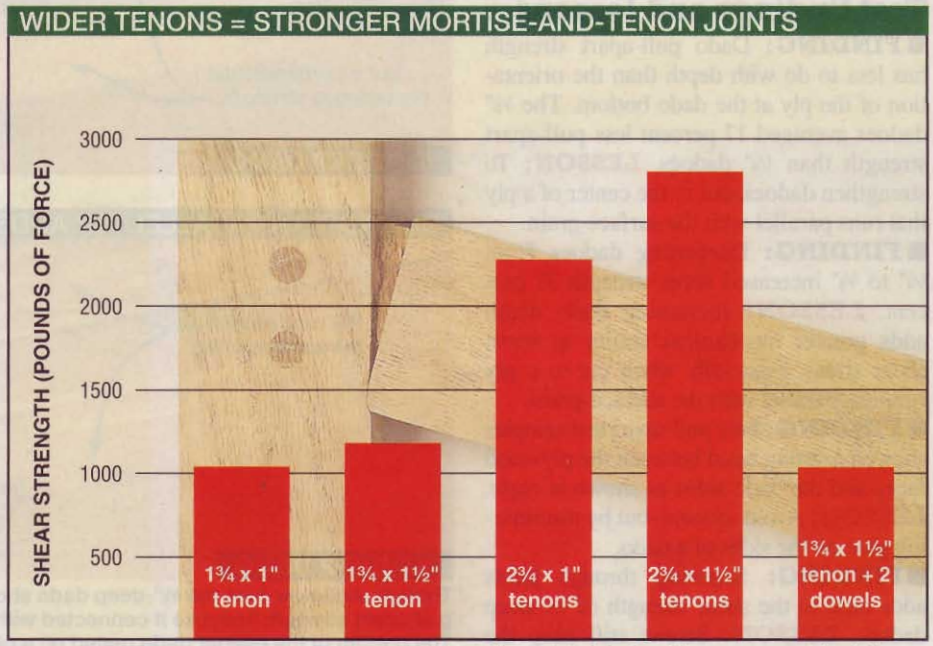
Test findings and lessons

■ **FINDING:** A tenon's width adds more strength than its length. **LESSON:** If you typically cut tenon cheeks the same depth on all four sides, widen the tenons by reducing the inset from the edges. Cutting just 1/16" from the workpiece edges still produces a uniform look around the joint line.

■ **FINDING:** In joints with the same size tenons, those with dowel pins were slightly weaker in both pull-apart and shear strength. **LESSON:** Though decorative, dowel pins added no strength to the mortise-and-tenon joints we tested. If you want dowels for appearance, lengthen the tenon or cut a through-tenon to surround dowels with more wood for added strength.

■ **FINDING:** The shear-strength chart *above right*, shows the pressure at which the joint failed completely. But we also observed a lower-pressure "breaking point" when the shoulder of the tenon separated from the edge of the mortised piece. On most shear-test samples, the glued tenon outlasted the surrounding mortise, as shown at *right*. **LESSON:** Gluing tenon shoulders to the edges of the mortise adds little but an opportunity for glue squeeze-out.

■ **FINDING:** Ragged surfaces with broken wood fibers reduce a mortise-and-tenon joint's strength. Smooth mortise sides and tenon face cheeks produce a tighter fit for the kind of strength that makes the glue joint stronger than the surrounding wood.

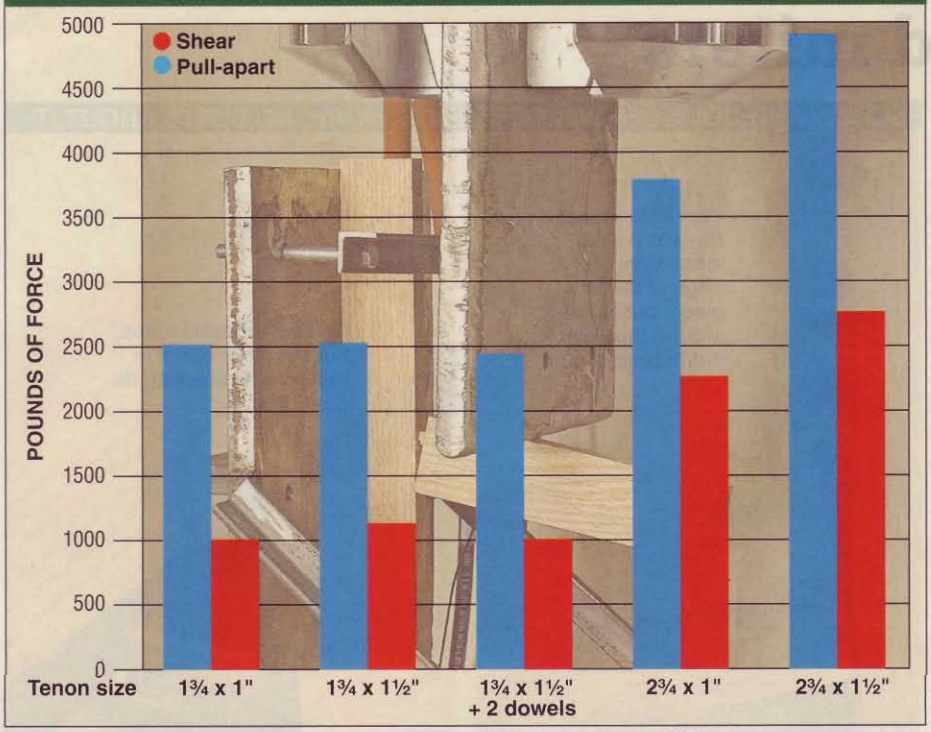


For workbenches, tables, and shelves that have to resist side-to-side movement in daily use or when being moved and handled, nothing beats mortise-and-tenon joints. Increasing the tenon width 57 percent more than doubled the joint strength.

SHEARING FORCE: WIDE TENONS DON'T LET GO
Downward force separates part of the tenon from the mortise sides.
The end-to-edge glue joint still pulls away wood.
1¾ x 1½" TENON
A wider, shallower tenon pulls away the adjoining wood of the mortise.
2¾ x 1" TENON

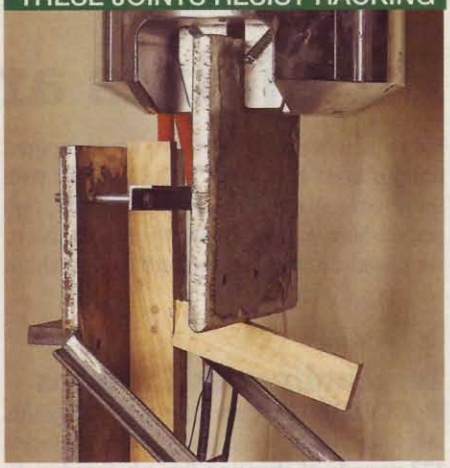
Making a tenon wider, but not as long, nearly doubled the shear strength of the mortise-and-tenon joint on the *right* versus the narrower tenon on the *left*.

ALL THESE MORTISE-AND-TENON JOINTS WITHSTOOD MORE THAN 1,000 LBS. OF FORCE



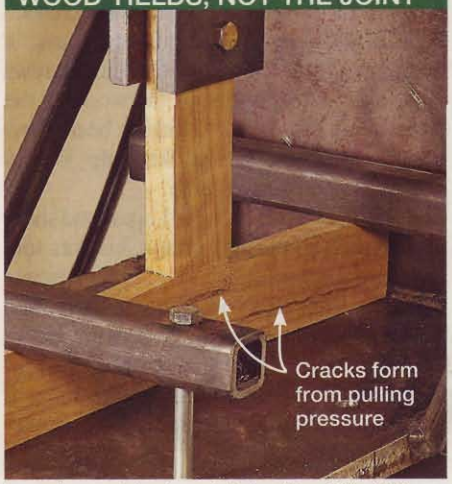
Longer tenons didn't always produce a stronger joint in our tests. Wider tenons outperformed the narrower ones, and dowel pins reduced pull-apart and shear strength.

THESE JOINTS RESIST RACKING



In mortise-and-tenon joint shear tests, a 1"-thick steel plate with a rounded edge presses down on the tenoned piece 3" from the mortised piece.

WOOD YIELDS, NOT THE JOINT



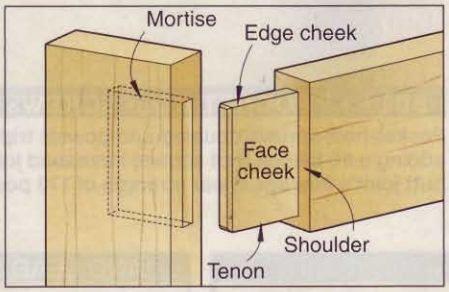
In pull-apart tests, a joint with a 2¾x1½" tenon withstood more than two tons of force before the mortised piece tore in half.

LESSON: If your dado blade or bandsaw leaves a rough face cheek, consider cutting tenons slightly oversize and sanding or planing them to fit the mortise.

■ **FINDING:** The 2¾x1½" tenon samples endured an average 2,739 pounds of shear force. **LESSON:** If that seems like joinery overkill, remember that we applied force gradually. Abrupt sideways force from working a plane on a bench or pushing a kitchen table sideways during a move stresses a joint more than gradual pressure.

■ **FINDING:** Wide tenons proved strong, but there's a limit to tenon width before wood movement differences between grain orientations of the mortise and tenon create problems. **LESSON:** On tenons that exceed 4" wide, cut a ⅛"-wide notch at the center to compensate for wood expansion.

■ **FINDING:** Few tenons broke in any of the test samples, like those shown *below*.



LESSON: The "rule of thirds" works. Divide the width of your workpieces into thirds to lay out your joint. If necessary, you can fudge your mortise width slightly to suit your machinery or hand tools.

PULL-APART FORCE: TOUGH TENONS REFUSE TO PULL LOOSE FROM THEIR MORTISES

This 2"-wide stock cracked nearly in half without releasing the tenon.
1¾ x 1" TENON
The tenon ends where the break begins.
2¾ x 1" TENON
Dowels weakened this vulnerable area of the joint.
1¾ x 1½" TENON

During the mortise-and-tenon pull-apart tests, no samples failed as a result of glue failure. Samples either broke in half *(left)*, cracked the stile piece lengthwise *(center)*, or a combination of both *(right)*.

Butt joints and miters

Here's what we tested: We compared unreinforced butt joints in ¾" red oak with those strengthened by two ⅜" dowels, two pocket-hole screws, or one #0 biscuit. Next, we tested unreinforced miters against those with one #0 biscuit.

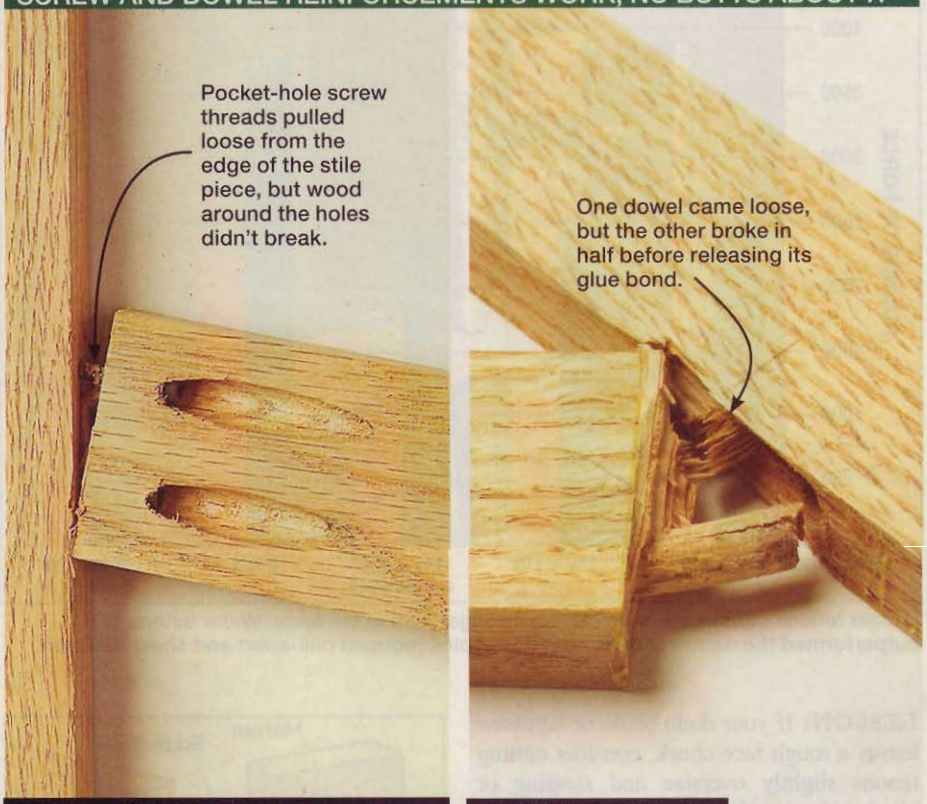
Test findings and lessons

■ **FINDING:** Unreinforced butt joints last longer than you'd think. Ours averaged 173 pounds of shearing force before breaking, even better than the shear strength in our ¼"-deep dado test. **LESSON:** When they fail, unreinforced butt joints break suddenly and completely, unlike joints reinforced with dowels or pocket-hole screws.

■ **FINDING:** In one pull-apart test, a butt joint reinforced with pocket-hole screws was strong enough to split the wood as the joint failed. **LESSON:** Nothing beats dowels for strength, but pocket-hole joinery comes close and saves time.

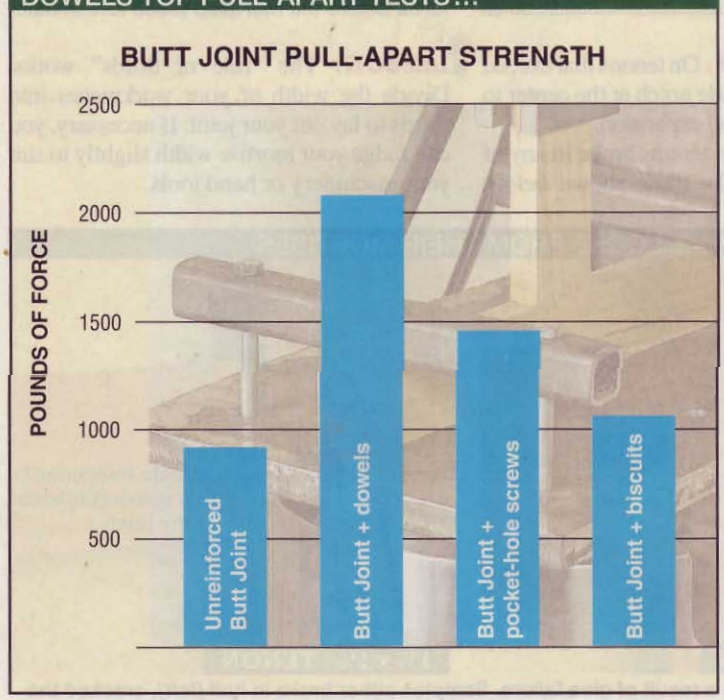
■ **FINDING:** In both pull-apart and shear tests of butt joints and miters, biscuits tore apart within their slots. **LESSON:** Biscuits were the least effective reinforcement, and the biscuit slot exceeded the 2"-wide pieces of our samples. Nevertheless, biscuits provide a quick way to reinforce joints that will endure few shocks and strains, such as picture frames.

SCREW AND DOWEL REINFORCEMENTS WORK, NO BUTTS ABOUT IT

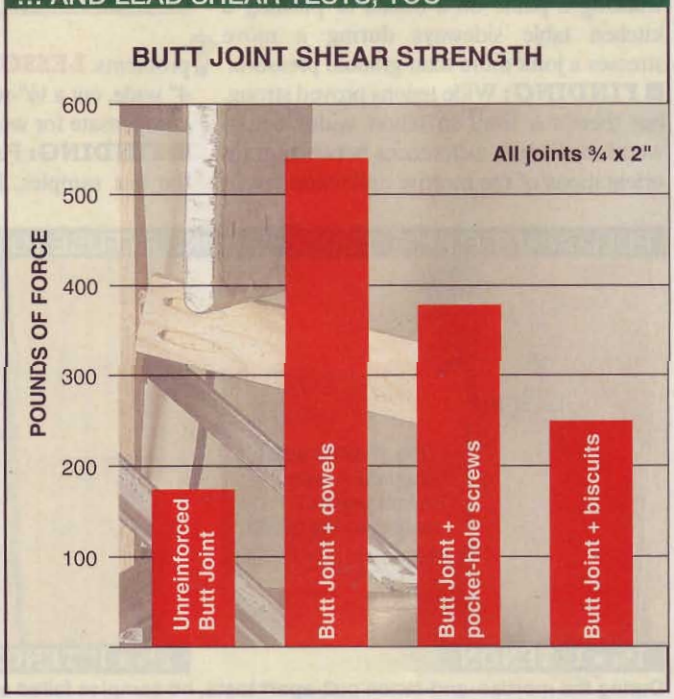

Pocket-hole screw threads pulled loose from the edge of the stile piece, but wood around the holes didn't break.
One dowel came loose, but the other broke in half before releasing its glue bond.
BUTT + 2 POCKET-HOLE SCREWS
BUTT + 2 DOWELS

Pocket-hole screws doubled and dowels tripled the shear strength of butt joints. Even adding a #0 biscuit (not shown) increased joint strength 46 percent over an unreinforced butt joint's average shear strength of 173 pounds.

DOWELS TOP PULL-APART TESTS...



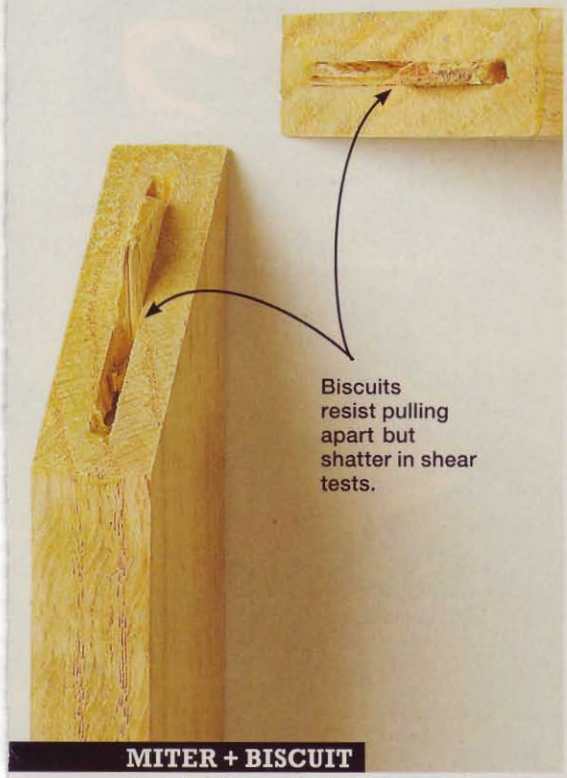
... AND LEAD SHEAR TESTS, TOO



By creating an edge-grain gluing surface, dowels outpaced all other butt joint reinforcements in both pull-apart and shear tests.

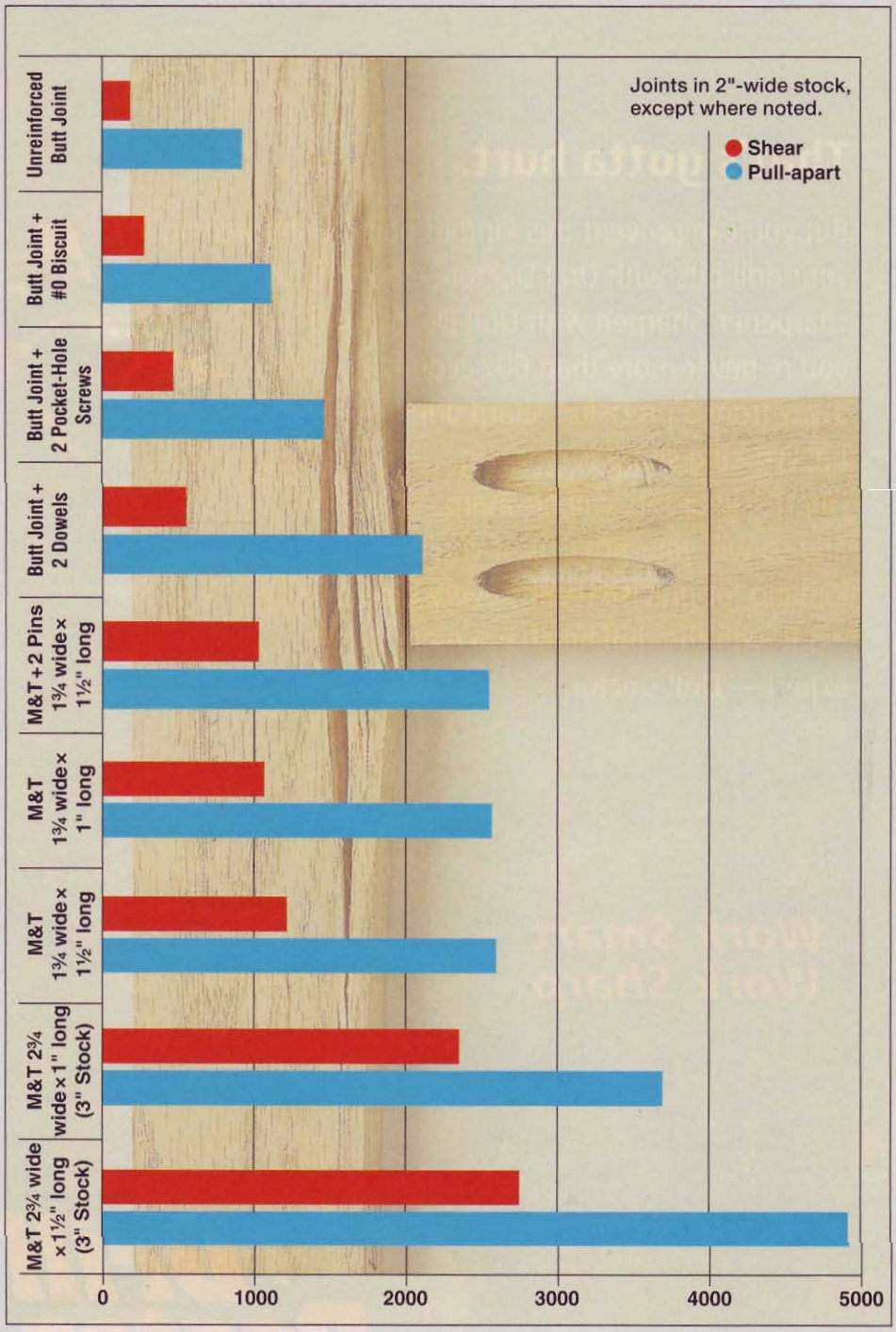
Compare these head-to-head results before choosing a joint

BISCUITS REINFORCE MITERS



MITER + BISCUIT

Even in ¾" stock just 2" wide, there's room for a #0 biscuit. Adding the biscuit increased pull-apart strength 62 percent, but added no shear strength.



■ **FINDING:** On our sample miters, the #0 biscuit extended a maximum of ¼" into the wood and reduced the edge-to-edge gluing surface 13 percent. **LESSON:** Biscuits increased miters' pull-apart strength by a third, but didn't increase shear strength.

■ **FINDING:** Flaws in the wood can compromise the strongest joint. **LESSON:** Inspect the wood surface around the joint for knots, checking, or discoloration that can signal a concealed wood flaw. Then check for flaws revealed during machining.

■ **FINDING:** Unreinforced butt joints failed at an average of 910 pounds in our pull-apart test, less than half the strength of doweled butt joints. That's because end grain provides a poor gluing surface. **LESSON:** Mix one part white or yellow glue in two parts water and apply this to the sanded ends to fill the grain. Allow the end piece to dry before gluing the joint.

Written by **Bob Wilson**
Illustrations: **Roxanne LeMoine** and **Tim Cahill**
Sample joints prepared by **Dean Fiene**

WHAT'S NEXT?

Do you have a favorite joint you want us to test? Send your suggestions to bob.wilson@meredith.com or to Bob Wilson, *WOOD* magazine, 1716 Locust St., LS-221, Des Moines, IA 50309-3023.

See video of joint torture tests at **woodmagazine.com/jointtest**

OIL vs. FILM

When it's time to apply a knockout finish, there are a lot of contenders. Some can take a punch; some bounce back fast. Here's how to choose the one that's a fair match for your project.

For many woodworkers, the contest to choose a finish ends in round one. Whether it's polyurethane, Danish oil, or spray lacquer, the winner never changes. But the finish you like best may not be the best one for your project, depending on its style and use.

All types of finishes have strengths and weaknesses, and a strength in one situation may become a weakness in another. For example, do you want a finish that's thin enough to apply fast and easily, or one that builds a thick, protective film in just a couple of coats? Should it be water- and chemical-resistant or easy to repair? Do you want a surface you can rub out to an even sheen or one that resists abrasion?

Clear finishes fall into six categories, each with its own mix of characteristics.

Meet the six contenders

Drying oils, including boiled linseed oil and pure tung oil, penetrate the wood surface and react with oxygen to cure. Boiled linseed oil contains drying agents that let it cure overnight, but tung oil can take several days. Tung oil, however, darkens less with time. Beware: Some finishes with "tung oil" in their name contain little or no real tung oil as an ingredient.

Oil/varnish mixes, such as Danish oil, enhance grain while laying down a thin film. Because of their oil content, oil/varnish mixes also need to dry overnight.

Lacquer combines nitrocellulose solids in a mixture of solvents to create a film finish that dries quickly and adds a faint amber tint. For a clearer finish, use cellulose acetate butyrate (CAB) lacquer. Unless you buy a formula that dries slowly enough to brush on, plan to spray most lacquers.

Water-based finish goes by many names that may include the words "lacquer" or "polyurethane," but most use acrylic or acrylic/polyurethane resins in solvent and water. By eliminating oil, and using acrylic and other clear resins, water-based finishes don't yellow as they age.

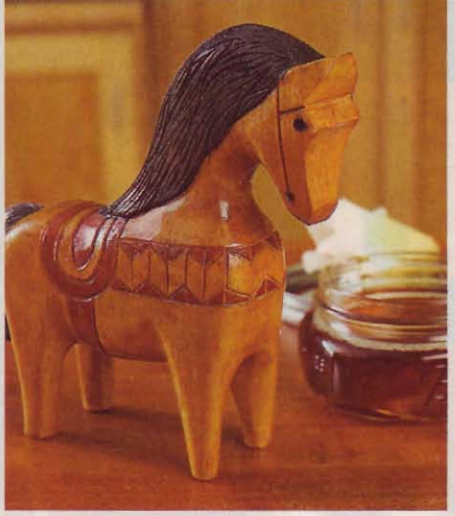
Wiping varnish, usually a type of polyurethane, comes premixed, but you can make your own by thinning regular varnish with mineral spirits.

Polyurethane varnish mixes alkyd and polyurethane resins with different types of drying oils. Unlike an oil/varnish blend, however, the ingredients are heated until they combine. Reducing the ratio of oil to resin creates a hard finish for indoor use. Increasing the amount of oil makes the finish flexible enough to withstand wood movement outdoors.

Now that you know the players, learn how to get the most from them.

The durability dilemma

On the following pages, we arranged these finish types with durability increasing from left to right. As durability increases, though, ease of repairs decreases. For example, lacquer offers little resistance to alcohol or water, but it's as easy to repair as spraying on a fresh coat. Polyurethane varnish ranks tops in moisture and chemical resistance, but repairing deep scratches requires stripping the old finish.



Drying oils

Easy to apply: Forget about streaks, drips, and brush marks. Just wipe on boiled linseed oil with a soft cloth or flood it on until you've saturated the wood surface. Then wipe off the excess and let it dry overnight before recoating, or one week before applying a film finish. To avoid spontaneous combustion from finish in the oil-soaked rags reacting with oxygen, hang or spread them out to dry before discarding.

Easily damaged, easily repaired: Drying oil cures too soft and thin to protect against moisture vapor or abrasion. It also darkens with time as it continues to oxidize. But the lack of a film build makes this the easiest finish to repair: Simply apply another coat of finish to damaged areas or when the surface starts to show wear.

Success secrets: Reapply oil where it soaks in completely, but wipe away surplus surface oil or it will cure soft and gummy. If the oil warms after it goes on, watch for "bleeding" from the wood pores, and wipe away these droplets before the oil cures. This may need to be done more than once, so check it periodically. Should you later want a more durable finish, oils still highlight grain beneath a film finish.

Try it on carvings and objects you'll handle infrequently where you want a natural, unfinished look. Also, apply it beneath a film finish to add an amber tone and to accent figured woods such as curly maple.

But avoid it for any project that requires moisture or abrasion resistance, especially outdoor projects. Oil provides almost no surface protection and does little to block moisture vapor, making it a poor choice for most furnishings you'll use every day.

Oil/varnish mix

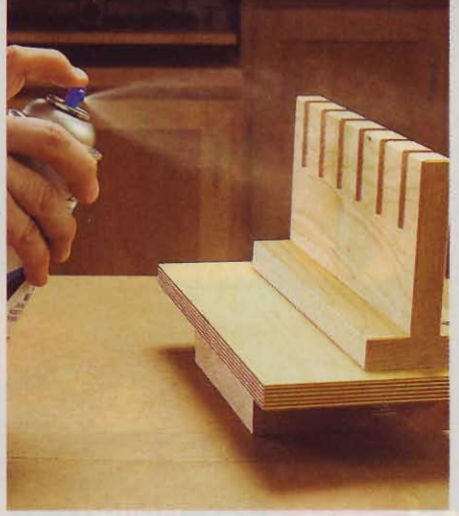
Goes on with a cloth: Comparable to drying oils for ease of application, these mixtures also penetrate the wood. The difference? They leave an extremely thin, soft surface film. As with oil, soak the surface evenly before you wipe away the excess. When discarding rags, follow the same cautions as for drying oils.

Minimal protection, but easy to fix: Adding varnish to these mixtures doesn't significantly increase a project's abrasion, moisture, or heat resistance compared with boiled linseed oil. But the very thin build makes oil/varnish blends easy to repair or retouch. Just smooth over light damage with 280-grit sandpaper and apply a fresh coat.

Success secrets: Drying oils and varnishes are compatible with each other when mixed, so you can create your own blend by combining equal parts of boiled linseed oil and any oil-based varnish. Increase the percentage of varnish to increase gloss, hardness, and moisture resistance. As with oil, flood the surface thoroughly and recoat places where the mixture soaks in completely. You even can use oil/varnish blend as a lubricant while finish-sanding with 600-grit or finer sandpaper, wiping away the surplus.

Try it on indoor projects where you'll want a soft, satin sheen, or a simple, rustic finish as on a simulated antique. Because it's easy to repair, you also can use it on shop-made workbenches and on tools such as the deadblow hammer shown *above*.

But avoid it for surfaces you'd rather protect against wear and abrasion instead of constantly repairing the finish, as on dining tables or chairs.



Lacquer

Easy to spray, harder to brush: Whether sprayed from a gun or an aerosol can, lacquer lays down a smooth, dust-free finish that dries quickly. However, high humidity can turn spray lacquer opaque, called "blushing." Slower-drying "brushing" lacquers provide another, though trickier, way to apply lacquer. Both types require a well-ventilated finishing area and lacquer thinner for cleanup.

Repairability/durability: Even old coats of lacquer can be dissolved with lacquer thinner for easy stripping. Or simply spray on a fresh coat to partially dissolve the uppermost layer and cover minor scuffs and scratches without refinishing. Lacquer dries to a hard surface that resists abrasion, moisture, and solvents less than varnish.

Success secrets: Customize lacquer to work in a variety of spray setups and climates by adding lacquer thinner to control viscosity and retarders to slow the drying speed. Don't have a spray gun? Aerosols work just as well, although they're thinned so much that more applications are needed. Apply spray-on lacquer in low humidity to avoid blushing. Lacquer's hardness makes it easier than polyurethane varnish to sand and then rub out the finish to a high shine. Avoid contaminating the wood surface with silicone—found in some lubricants and furniture polishes—which can produce small dimples in the surface, called fish eye.

Try it on all furnishings not subject to moisture contact or rough handling. Use CAB acrylic lacquer as a crystal-clear alternative to water-based finishes for a nonyellowing film.

But avoid it for high-abuse projects such as kids' toys and furnishings.

Water-based finish

Quick drying, quick cleanup: Water-based finish sprays or brushes on easily, but it dries quickly enough that you have to work fast to avoid brush marks. Water-based finishes release fewer odors than oil-based varnish or lacquer, but still contain solvents. Apply them in well-ventilated locations while wearing a respirator. Soap and water take care of cleanup before the finish dries.

Moderately durable, but a problem to patch: Water-based finishes won't redissolve like lacquer or cure thin like an oil/varnish mix, making them harder to repair than lacquer or drying oils. Water-based finishes compare to lacquer for durability, but deteriorate from chemicals such as glass cleaners with ammonia, and from constant contact with bare skin.

Success secrets: To minimize grain-raising problems with water-based finishes, first moisten the grain to raise it and gently sand away nibs before applying a sealer coat. Water-based finishes dry slowly enough to form runs, so apply light coats and sand lightly between coats with 220-grit abrasive. Avoid rebrushing freshly applied finish, which can leave streaks and bubbles. Also, apply water-based finish when the temperature is 60–90° F and the humidity is 50 percent or less.

Try it on projects where you'd use oil-based varnish but don't require its abrasion and moisture resistance. The clarity of water-based finishes makes them ideal for light woods such as maple, where you want to preserve the wood's natural color.

But avoid it for projects where you need exceptional water and chemical resistance.

Wiping varnish

Wipes on fast, but builds slowly: Almost as easy to apply as an oil/varnish blend, wiping varnish dries quickly enough to reduce brush marks and dust nibs. You also eliminate runs and sags when applying wipe-on finishes in thin coats. Using a rag instead of a brush eliminates cleanup. The downside: You'll need to apply at least two coats of wipe-on varnish to equal one coat of full-strength varnish.

More coats equal more durability: Although each coat of wipe-on varnish goes on thin, the film it leaves complicates repairs as much as unthinned varnish. Sand and recoat light scuffs and scratches. For deep scratches—especially on stained wood—strip and refinish the surface. Allow finish-soaked rags to dry before discarding them.

Success secrets: Avoid the temptation to apply thick coats, which can run and drip. Premixed wiping varnishes save time, but you'll save money by making your own. Thin full-strength varnish 25–50 percent with mineral spirits until you achieve a balance of smoothness and thickness. You can use polyurethane, but an alkyd-resin varnish also will work. Despite the name, you can brush on wiping varnish, although that works best on horizontal surfaces, where it won't run or drip.

Try it on any project where you would use full-strength varnish but have the luxury of time to apply several coats. It's especially useful for reaching into nooks and crannies on carvings or routed profiles.

But avoid it for surfaces that must be easy to repair. Like full-strength varnish, it will also add an amber or yellow cast to light woods, including pine and maple.

Polyurethane varnish

Brush with care: Slow-drying full-strength polyurethane has a frustrating knack for catching dust nibs and, when applied too thickly, running and dripping. It's better brushed than sprayed because overspray sticks to everything. Polyurethane's abrasion resistance makes it difficult to rub out, and cleanup requires using mineral spirits.

Tricky to apply, but difficult to damage: Nothing short of chemical strippers or aggressive sanding will remove polyurethane, but that also helps it survive wear, moisture, and chemical damage in the first place. Plus, polyurethane's heat resistance makes it a sound choice for projects such as this casserole carrier, shown *above* and on *page 40.*

Success secrets: Despite what it says on the label, polyurethane can be thinned 5–10 percent with mineral spirits until it brushes on smoothly and dries slowly enough for bubbles to pop and brush marks to level out. More so than with any other finish shown here, success depends on applying poly to a clean surface in a dust-free environment.

Try it on any project where you want high wear resistance. Choose it for projects that will take the most daily abuse such as kitchen tables, chairs, and kids' toys.

But avoid it for furnishings you'll rub out to a high-gloss shine, or projects where easy repairs are essential. It's also less convenient to apply than spray lacquer or even wiping varnish for display pieces such as a mantel clock or decorative box.

By **Bob Wilson** with **Bob Flexner**

Durability

tile-topped keepsake box

Keep jewelry, photographs, letters, and other cherished items in this stylish case that features an eye-catching ceramic centerpiece.

AT A GLANCE

- Overall dimensions are 8" wide × 8" deep × 4⅛" high.
- We used traditional quartersawn white oak for this Arts & Crafts-style project. Cherry, walnut, or mahogany also makes a good choice.
- For tile/hardware and wood kits, see **Sources** on *page 72*.

Here's a project you'll enjoy building and—even more—presenting to someone special. The case assembles with straightforward rabbet-and-groove joinery, and you easily can shape the beveled lid with tile-holding rabbet using your tablesaw. You can select from the four tile designs shown in the sidebar "About the ceramic tiles" on *page 72*. Or, you can showcase a different item, such as a photo or stained glass, by modifying the rabbet size and width of the lid sides, as needed.

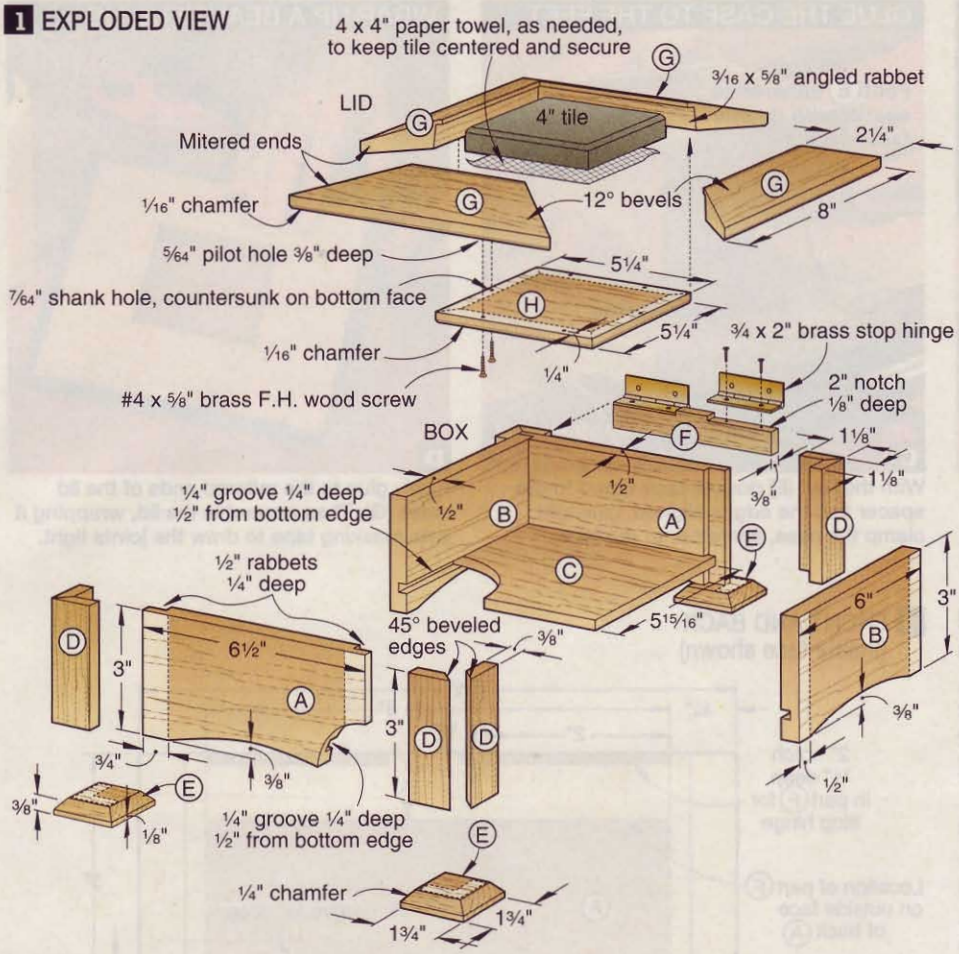
Start with the case

1 From ¾" stock planed to ½" thick, cut the front and back (A) and sides (B) to the sizes listed in the **Materials List**. Then, from ¾" stock resawn or planed to ¼" thick, cut the bottom (C) to size.

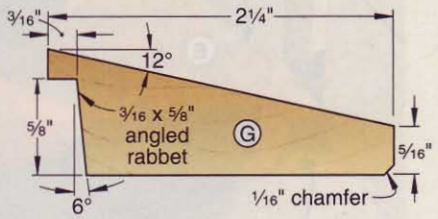
2 Cut a ½" rabbet ¼" deep across each end of the front and back (A) on the *inside*

Brass stop hinges hold the lid open for convenient box access.

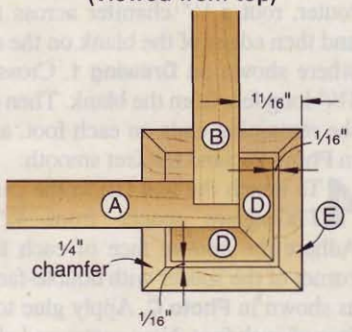
1 EXPLODED VIEW



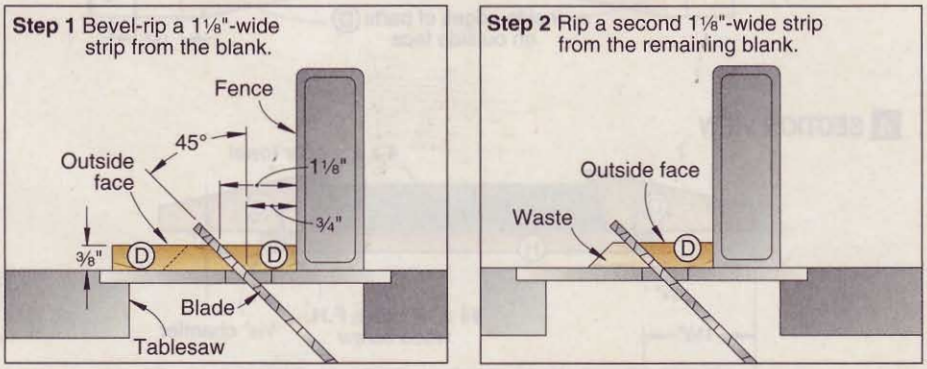
1b LID SECTION VIEW



1a FOOT LOCATION DETAIL (Viewed from top)



2 RIPPING THE LEG BLANK FOR GRAIN-WRAPPED PARTS



face, where shown on **Drawing 1**. Then cut a ¼" groove ¼" deep ½" from the bottom edges of the front, back, and sides (A, B) on the *inside* faces to fit the bottom (C).

3 Mark the centers and ends of the arches on the front and back (A) and sides (B), where dimensioned on **Drawing 1**, noting that the arches are ¾" from the ends of the front and back and ½" from the ends of the sides. Draw the arches using a fairing stick. (For a free fairing stick plan, go to woodmagazine.com/fairing.) Bandsaw and drum-sand the arches to shape.

4 Sand the front and back (A), sides (B), and bottom (C) to 220 grit. Then glue and clamp the parts together, checking for square. (We did not glue the bottom in the case to allow for expansion and contraction.)

Add the legs and feet

1 From ¾" stock planed to ⅜" thick, cut a 2½×14" blank to form the legs (D). To create grain-wrapped leg pairs, bevel-rip two 1⅛"-wide strips from the blank, using the two-step process shown on **Drawing 2**. Identify the top end of each strip to ensure correct orientation for grain wrapping. Then, starting at the marked end, crosscut four 3"-long legs from each strip, pairing the mating pieces together. With the ends flush, glue the pairs tight together, as shown in **Photo A**.

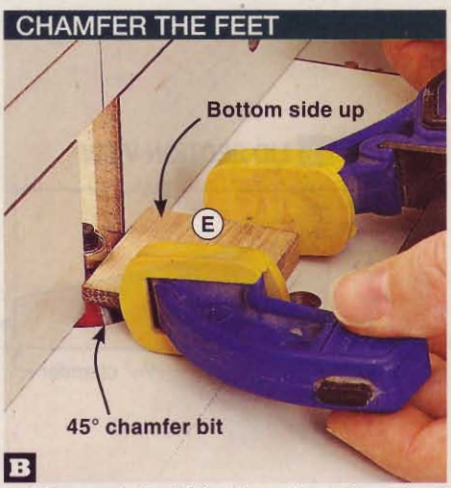
ASSEMBLE THE LEGS

A

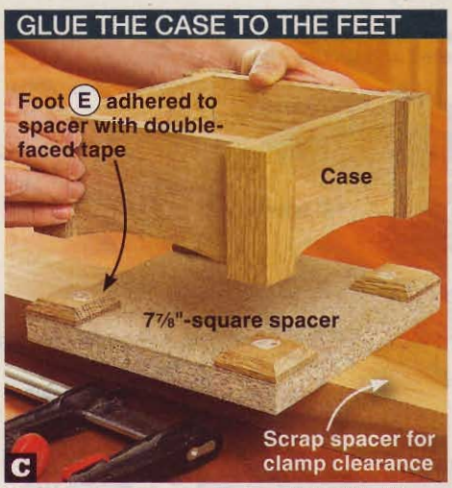
Place each pair of legs on masking tape. Apply glue to the beveled edges. Then fold and tape the pieces together with the joint tight.

2 Sand the assembled legs (D) smooth. Then glue and clamp them to the case, keeping the ends flush with the top and bottom edges of the case.

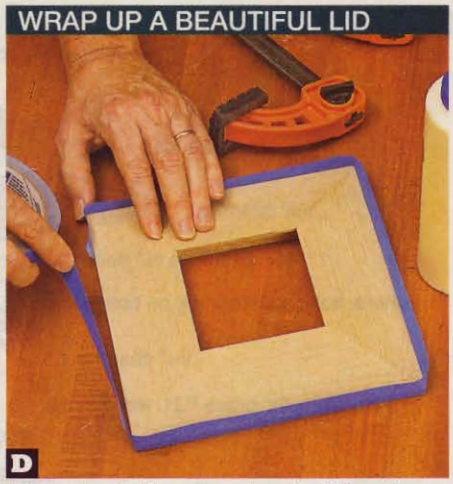
3 From ¾" stock planed to ⅜" thick, cut a 1¾×8" blank for the feet (E). Using a



Holding each foot (E) with a clamp for safety and keeping the foot flat on the table, complete the chamfered edges on the *top* face.



With the feet (E) double-face-taped to the spacer and the edges aligned, glue and clamp the case, centered, to the feet.



Apply glue to the mitered ends of the lid sides (G). Then assemble the lid, wrapping it with masking tape to draw the joints tight.

45° chamfer bit in your table-mounted router, rout a ¼" chamfer across the ends and then edges of the blank on the *top* face, where shown on **Drawing 1**. Crosscut four 1¾"-long feet from the blank. Then chamfer the remaining ends on each foot, as shown in **Photo B**. Sand the feet smooth.

4 To attach the feet (E) to the case, cut a 7⅞"-square spacer from ¾" scrap. Adhere the *bottom* face of each foot to a corner of the spacer with double-faced tape, as shown in **Photo C**. Apply glue to the *top* face of each foot. Now center and clamp the case to the feet with the legs (D) located 1/16" from the chamfered edges of the feet, where dimensioned on **Drawing 1a**.

Now let's head for the lid

1 From ¾" stock planed to ⅜" thick, cut the hinge support (F) to size to fit snugly between the back legs (D), where shown on **Drawings 1** and **3**. Lay out a 2" notch ⅛" deep at each end of the support at the *top* edge to fit ¾x2" brass stop hinges. Bandsaw the notches. Sand the support smooth, and set it aside.

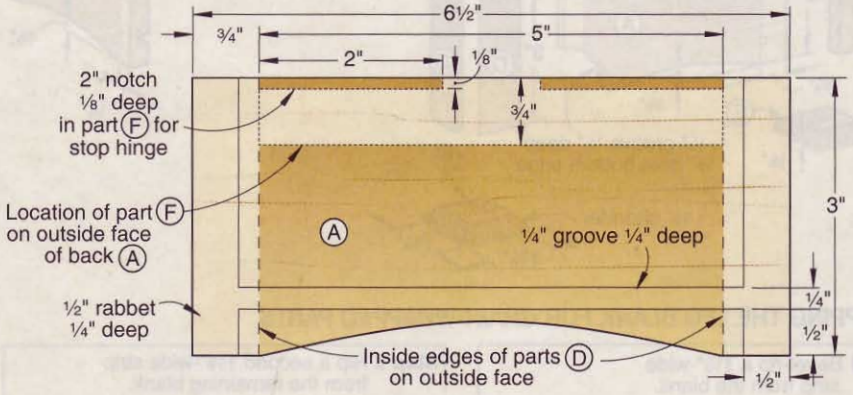
2 From your best piece of flecked ¾" stock, cut a 2½x35" blank for the lid sides (G). To form a 12° beveled face on the blank (without losing the flecking) and angled 3/16x⅝" rabbet to receive the ceramic tile, where dimensioned on **Drawings 1** and **1b**, see the sidebar "How to machine the beveled lid and preserve the prized flecking," *opposite page*.

3 To complete the lid, rout a 1/16" chamfer along the bottom front edge of the blank. Then miter-cut the 8"-long lid sides (G) from the blank. Glue and assemble the lid, as shown in **Photo D**.

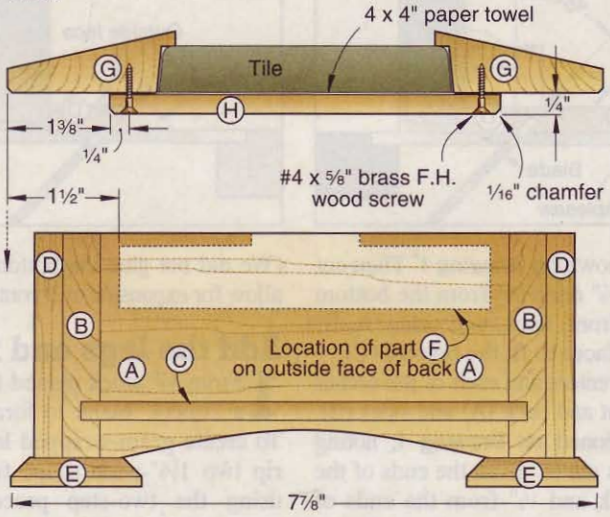
4 From ¾" stock resawn or planed to ¼" thick, cut the tile retainer (H) to size. Rout a 1/16" chamfer around the retainer on the *bottom* face, where shown on **Drawings 1** and **4**. Sand smooth.

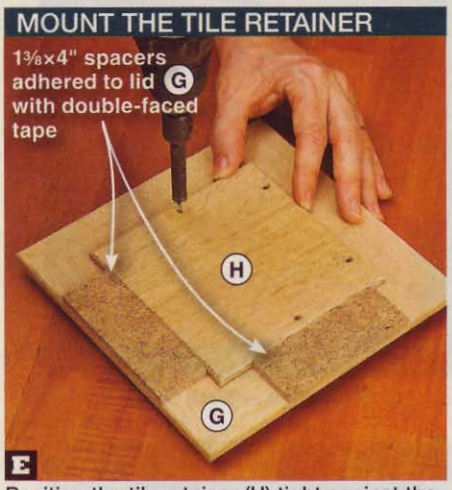
5 To mount the tile retainer, centered, to the lid, where dimensioned on **Drawing 4**, cut two 1⅜x4" spacers from ¼" hardboard. Adhere the spacers to the *bottom* of the lid, flush with the edges, using double-faced tape, as shown in **Photo E**. Then position the tile retainer tight against the spacers. Drill mounting holes through the retainer and into the lid, where shown on **Drawings 1** and **4**. Drive #4x⅝" *steel* flathead wood

3 FRONT AND BACK
(Inside face shown)

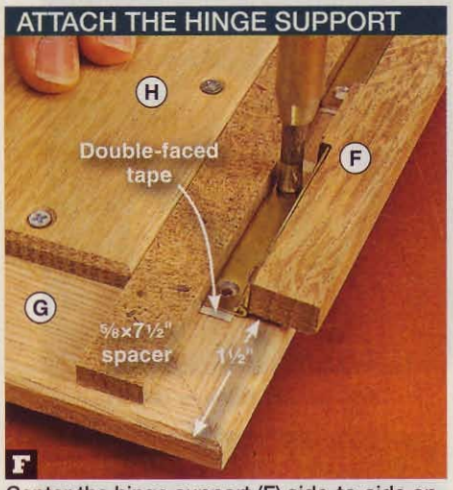


4 SECTION VIEW





Position the tile retainer (H) tight against the spacers on the lid (G). Drill mounting holes ¼" from the edges of the retainer.



Center the hinge support (F) side-to-side on the lid (G) with the hinges tight against the spacer. Drill the mounting holes in the lid.

Place pieces of paper towel on the back of the tile, as needed, to keep it centered and snug with the tile retainer (H) in position.

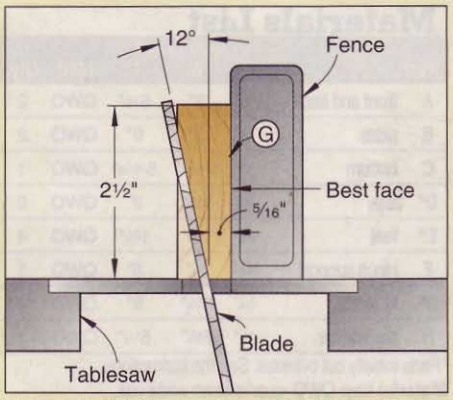
screws to prethread the holes. (This avoids breaking the softer brass screws that you'll install for final assembly.)

6 Position a ¾×2" brass stop hinge in a notch in the hinge support (F), flush with the *inside* face and end. Using a self-centering bit, drill pilot holes for the screws supplied with the hinges. Prethread the holes using #3×⅜" *steel* flathead wood screws, and then replace the screws with brass screws. Repeat to mount the remaining hinge.

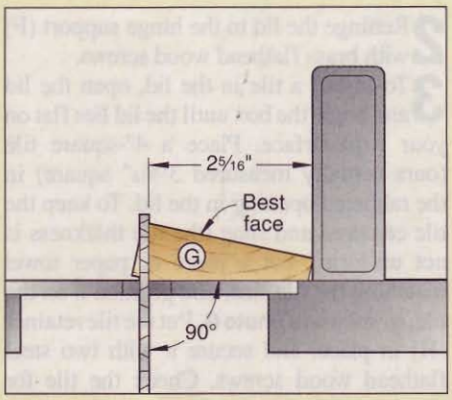
7 To mount the lid/tile retainer (G/H), centered, on the case, cut a ⅝×7½" spacer from ¼" hardboard. Position the spacer against the back edge of the tile retainer (H), as shown in **Photo F**. Apply double-faced tape to the bottom of each free

How to machine the beveled lid and preserve the prized flecking

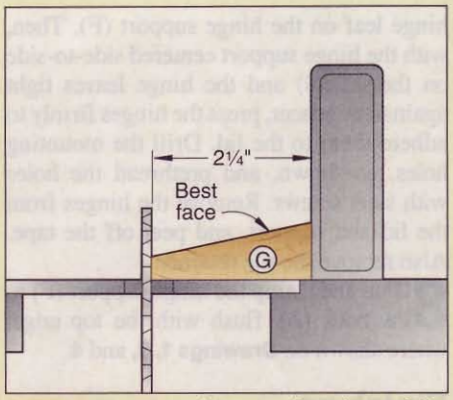
If you cut the 12° bevel for the lid (G) on the best face of your quartersawn stock, you may lose the treasured ray flecking. To prevent this, simply cut the bevel on the *bottom* face (which, when flat, leaves the top angled) and resquare the edges. Here's how to do this and machine the angled 3/16×⅝" rabbet to fit the ceramic tile, where dimensioned on **Drawings 1** and **1b**.



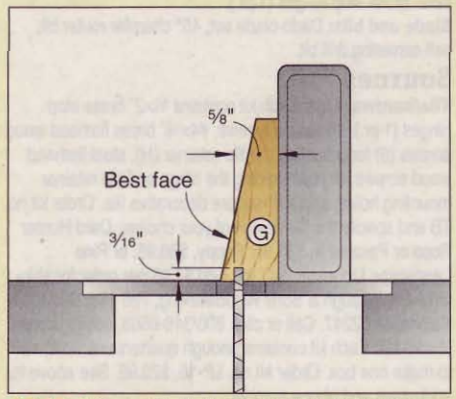
STEP 1 With the best face of a ¾×2½×35" blank for the lid sides (G) *against* the fence, bevel-rip the blank at 12°.



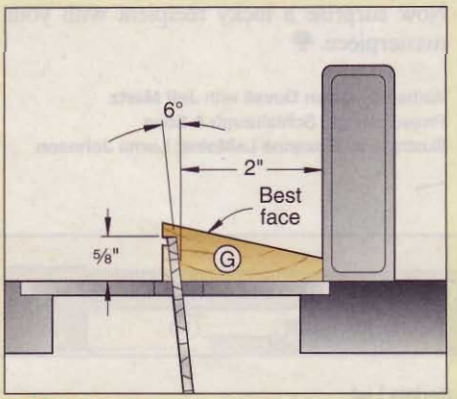
STEP 2 Return the blade to 90° and reposition the fence 2 5/16" from the blade. With the best face of the blank up, rip the wide edge.



STEP 3 To square the opposite edge, rotate the blank end to end. Reposition the fence 2¼" from the blade, and rip the blank.



STEP 4 Cut a 3/16"-deep kerf ⅝" from the bottom face of the blank along the wide edge to form an angled rabbet for the tile.



STEP 5 Complete the angled rabbet by making a 6° bevel cut ⅝" deep 2" from the narrow edge of the blank.

STEP 6 Check that each edge of the tile fits into the rabbet. If needed, increase the depth of the rabbet using a sanding block.

About the ceramic tiles

The decorative tiles used for this project are handcrafted by Motawi Tileworks of Ann Arbor, Michigan. Using an ancient process known as basin style, small raised lines of clay form pockets that pool the multicolor glazes. Because they're handmade, the tiles cost more than factory-produced tiles but offer unique colors, textures, and designs. As noted in **Sources**, you can choose from the four designs shown. To learn more about the tiles, go to motawi.com.

Dard Hunter Rose — Green

Pasadena — Dark Oak

Pine Landscape Mountain

Poppy — Green Salmon

hinge leaf on the hinge support (F). Then, with the hinge support centered side-to-side on the lid (G) and the hinge leaves tight against the spacer, press the hinges firmly to adhere them to the lid. Drill the mounting holes, as shown, and prethread the holes with steel screws. Remove the hinges from the lid and support, and peel off the tape. Also remove the tile retainer.

8 Glue and clamp the hinge support (F) to the back (A), flush with the top edge, where shown on **Drawings 1, 3,** and **4**.

Finish up

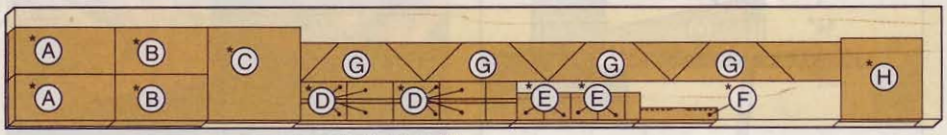
1 As needed, finish-sand any areas of the lid and case to 220 grit, and remove the dust. Apply a stain and clear finish of your choice, or try the Arts & Crafts reproduction finish that we used, as explained on *page 73*, which gives the project a rich color and makes the ray flecking pop.

2 Rehinge the lid to the hinge support (F) with brass flathead wood screws.

3 To install a tile in the lid, open the lid and angle the box until the lid lies flat on your worksurface. Place a 4"-square tile (ours actually measured 3 13/16" square) in the rabbeted opening in the lid. To keep the tile centered and snug (the tile thickness is not uniform), cut a piece of paper towel matching the tile size, and position it on the tile, as shown in **Photo G**. Put the tile retainer (H) in place, and secure it with two steel flathead wood screws. Check the tile for looseness. Cut and add paper towels as needed to secure the tile. Replace the steel screws in the retainer with brass screws. Now surprise a lucky recipient with your masterpiece.

Written by **Owen Duvall** with **Jeff Mertz**
Project design: **Schlabaugh & Sons**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

Cutting Diagram



¾ x 7¼ x 60" Quartersawn white oak (3.3 bd. ft.)
*Plane or resaw to the thicknesses listed in the Materials List.

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	front and back	½"	3"	6½"	QWO	2
B	sides	½"	3"	6"	QWO	2
C	bottom	¼"	5 15/16"	5 15/16"	QWO	1
D*	legs	⅜"	1⅛"	3"	QWO	8
E*	feet	⅜"	1¾"	1¾"	QWO	4
F	hinge support	⅜"	¾"	5"	QWO	1
G*	lid sides	¾"	2¼"	8"	QWO	4
H	tile retainer	¼"	5¼"	5¼"	QWO	1

*Parts initially cut oversize. See the instructions.
Material key: QWO–quartersawn white oak.
Supplies: Easy-release painter's tape, double-faced tape, #4x5/8" steel flathead wood screws (6), #4x5/8" brass flathead wood screws (6), #3x3/8" steel flathead wood screws (4), ¾x2" brass stop hinges (1 pr.).
Blade and bits: Dado-blade set, 45° chamfer router bit, *self-centering drill bit.*

Sources

Tile/hardware kit: Each kit contains ¾x2" brass stop hinges (1 pr.) with brass screws, #4x5/8" brass flathead wood screws (6) for mounting the tile retainer (H), steel flathead wood screws for prethreading the hinge and tile retainer mounting holes, and a 4"-square decorative tile. Order kit no. TB and specify the tile design of your choice: Dard Hunter Rose or Pasadena, $31.95; Poppy, $36.95; or Pine Landscape Mountain, $41.95. Add $7.95 per order for shipping. Schlabaugh & Sons Woodworking, 720 14th Street, Kalona, IA 52247. Call or click 800/346-9663, schsons.com.
Wood kit: Each kit contains enough quartersawn white oak to make one box. Order kit no. LP-16, $23.95. See *above* for addresses and phone number.

create an authentic mission finish

Make quartersawn oak grain come alive.

Original mission-style furniture finishers colored white oak's grain and ray flecks by fuming the wood with ammonia. That created a problem though: Fuming turns different boards a mixture of colors. So furnituremakers evened out those color differences using a blend of lacquer, shellac, and dye. Today, the same type of finish works just as well on unfumed white oak. Plus, today's version benefits from newer, more consistent liquid dyes and lacquer formulas. Here's how to get that authentic and even mission-finish look without the fumes.

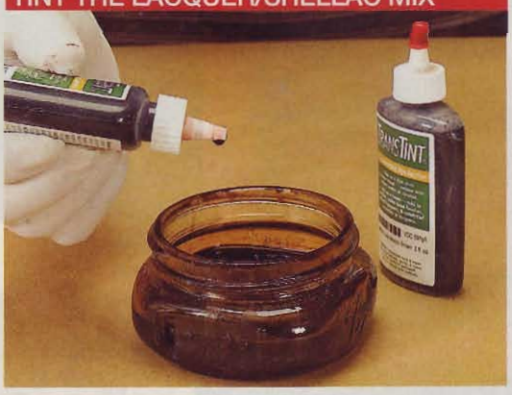
Step 1 Begin by mixing one part of 1# cut super-blonde shellac (1 ounce of shellac flakes in 8 fluid ounces of denatured alcohol) to two parts (16 ounces) brushing lacquer. Then add three parts of TransTint dark mission brown dye to each part of reddish brown dye until you reach the desired tint. For the finish shown here, we used 4 ounces of shellac and 8 ounces of brushing lacquer tinted with 45 drops of dark mission brown and 15 drops of reddish brown.

Step 2 Brush a liberal coat of the mixture over a small area. Immediately wipe away the excess finish with a clean cloth until you're left with an even color. Allow the finish to dry overnight. Don't attempt to spray on this coat; that produces a muddy look.

Step 3 If you plan to spray on the clear topcoats, mix an identical blend of shellac and lacquer, but without the dye. If you don't have spray equipment, substitute satin sheen aerosol spray lacquer. Spray on two coats of either finish, as shown, sanding with 320-grit abrasive between coats. Allow the final coat to dry overnight.

Step 4 Apply dark brown paste wax. Once it dries to a haze, buff with burlap or a medium-coarse cloth for an even sheen.

TINT THE LACQUER/SHELLAC MIX



SPRAY ON A CLEAR TOPCOAT

Source

Dye: Dark mission brown (no. 128486) and reddish brown (no. 128483), $17. Woodcraft, 800/225-1153 or woodcraft. com.
Shellac: Woodcrafters' Shellac, Paxton Woodcrafters' Store, 877/648-3752 or paxtonwood.com.
Lacquer: Clear Wood Finish (brushing lacquer) and aerosol lacquer in satin finish. Deft, 800/458-3338 or deftfinishes.com.
Tinted wax: Briwax ebony (no. 144609), $14 for 16 ounces. Woodcraft.

SHOP-TESTED

benchtop planers

Like a magic diet pill, these machines make thick boards thinner with no sweat and little heavy lifting—unless you include hefting the planer itself.

Spend a little money on a planer today and you'll save money for a lifetime: Instead of paying home-center prices for pre-planed boards, you can buy less-than-perfect lumber in a wide variety of species—including exotics—and thickness it yourself.

Planers come in two varieties. Large, stationary machines handle stock up to 15" or 20" wide (depending on the model) and cost from $800 on up. More common, though, are planers capable of machining stock up to 13" wide and selling for $200–$500. We put nine such models through their paces to find out which one is best for you and your budget.

Before we dig into our test results, let's bury the old name for this class of machines—portable planers—because each new model seems to get less portable. The lightest planer in our test weighs in at 53 lbs; the heaviest, nearly twice that.

Cut quality: It comes down to scallops and snipe

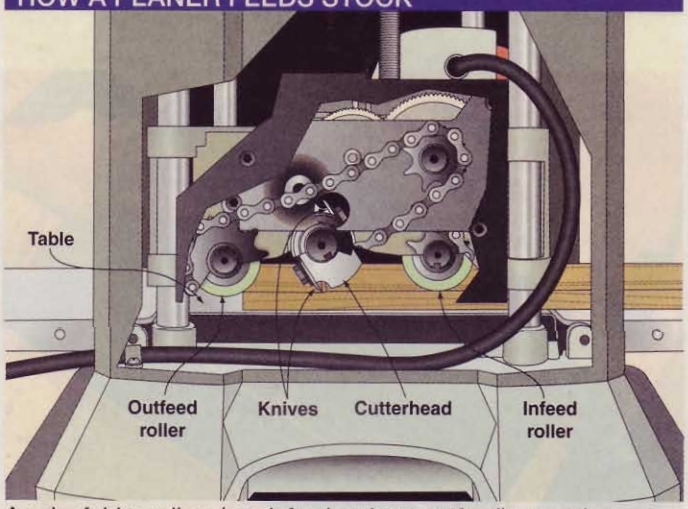
To plane a board to thickness by hand, you'd literally shave it down one stroke at a time, using a single blade in a jack plane. A planer multiplies that action exponentially, with two or three knives mounted around a rotating cutterhead, as shown *below*. This rotary cutting action results in a series of shallow scallops that makes the board essentially flat, and the closer those scallops are together, the smoother the surface. That's why you'll often see "cuts per inch" (cpi) listed in a planer's specs. Planer manufacturers increase cpi by speeding the cutterhead (rpm), adding a knife, slowing the board feed rate, or some combination of the three.

But is cpi a reliable gauge of cut quality? To find out, we planed 30"-long oak boards of various widths (2", 5½", and maximum) and thicknesses (1" and ¼") with each planer. On machines with two feed speeds (Delta 22-580, DeWalt DW735, and Jet JWP13DX), we ran tests at both fast (dimensioning) and slow (finishing) rates. Then we rubbed blue chalk onto the planed surfaces to visualize imperfections. The DeWalt DW735 left the smoothest surface (shown at *right, top*), thanks to its three knives and 14-feet-per-minute feed speed, which combine for a test-high 179 cpi. However, the Ryobi AP1301, with only 58 cpi, cut as cleanly as the Delta 22-580 in finishing mode (90 cpi). Boards planed by these machines were nearly as smooth as those planed with the DW735.

The second measure of cut quality is snipe: the annoying tendency of planers to take a too-deep bite a few inches from each end of a board. Snipe happens when only one drive roller engages the workpiece, allowing it to rock the head or lift up slightly into the cutterhead.

Snipe measuring less than .002" deep hand-sands away easily; here, the Jet JWP13DX and Delta 22-580 made the grade. Between .002" and .003" requires power sanding to smooth, and anything deeper will need to be cut off. Just as you wouldn't expect a tablesaw to cut perfectly out of the box, a planer usually needs some adjustment (see *page 81*) to minimize snipe; so we tweaked each machine to its peak performance before measuring the snipe shown in the chart at *right*.

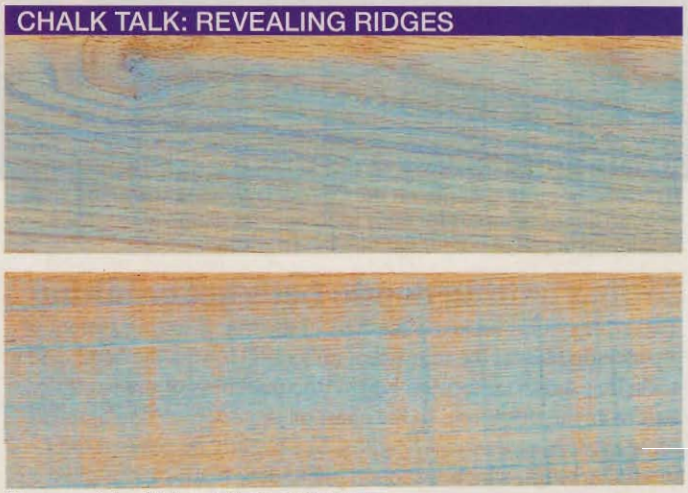
HOW A PLANER FEEDS STOCK



A pair of drive rollers (one infeed and one outfeed) press the workpiece flat against the table while moving it under the cutterhead, from right to left as shown in this drawing.

We reduced snipe on most of the planers by adjusting the height of their infeed and outfeed tables to limit the workpiece tilting that contributes to snipe. (DeWalt's DW735 extension tables are optional; Ryobi doesn't offer extensions for its AP1301.) The three biggest snipers, however—the bargain-priced Delta TP305, Grizzly G0505, and Ryobi—all lack a head lock that prevents the head from deflecting at the beginning or end of a cut.

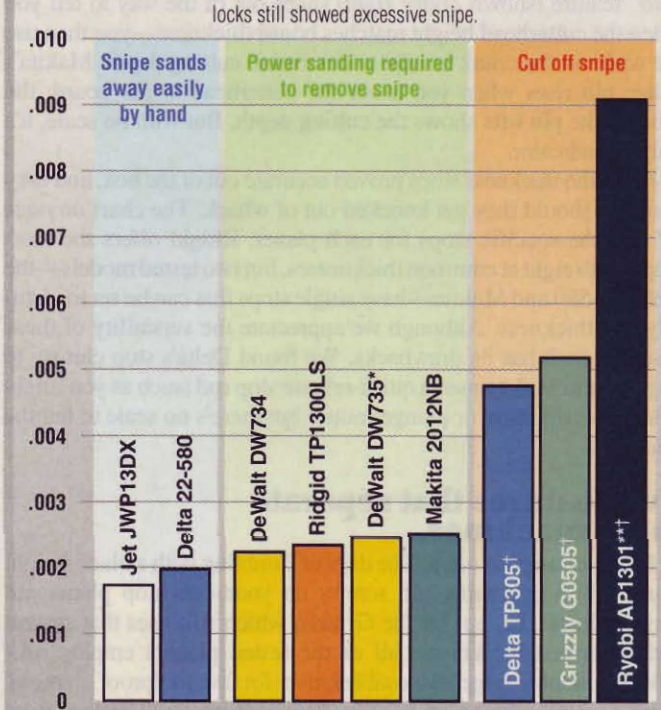
CHALK TALK: REVEALING RIDGES



The consistent blue color on the DeWalt DW735-planed board (*top*) proves its smooth cut. Grizzly's cutterhead dug deeper (light or no chalk) and left high spots (dark blue lines) along the board (*above*).

PLANERS WITHOUT CUTTERHEAD LOCKS SNIPE DEEPER

We decreased snipe in nearly all of the planers by making adjustments to the infeed and outfeed tables, if so equipped. However, the three models without head locks still showed excessive snipe.



Snipe measured after taking 1/32"-deep cuts in 5½"-wide red oak. Average of infeed and outfeed snipe on three test cuts. *Tested with optional infeed and outfeed tables. **No infeed or outfeed tables available for this model. †No head lock on this planer.

ALL THE CUTTING INFO YOU NEED AT A GLANCE

Each 1/32" of cutting depth on the DeWalt DW735 is shown by lines spaced about 1/8" apart for easy reading. The gauge also shows maximum depth of cut for various board widths.

GAUGING CUTTERHEAD HEIGHT WITH A "POP!"

Press down Delta's "blade zero" indicator, slide a workpiece under it, and then lower the cutterhead until it pops up. The cutterhead height now matches the board thickness.

Setting cutting depth: Let's get cranking

Two components make up the typical thickness-setting system of a benchtop planer: the crank that raises and lowers the head, and a scale that shows cutterhead height (the thickness of the workpiece as it exits the machine). In the chart on *page 79*, we downgraded some models' cutterhead-height scales slightly because of their small markings, which we found difficult to read.

All but the low-dough Delta TP305, Grizzly, and Ryobi also have some variety of material-removal gauge (showing how much wood will be planed away) and a thickness stop for reliably and repeatably returning to a specific thickness. We favor gauges with widely spaced markings, such as those on the DeWalt DW735, shown *above*, and the Ridgid TP1300LS. The Delta 22-580 and Makita 2012NB lack gauges, but still indicate cutting depth. Delta's "blade zero" feature (shown *above right*) snaps out of the way to tell you when the cutterhead height matches board thickness—you then use the scale on the crank handle to determine cutting depth. Makita's gauge pin rises when you lower the cutterhead to the board; the amount the pin lifts shows the cutting depth. But with no scale, it's only an indicator.

All of the thickness stops proved accurate out of the box, and easy to adjust should they get knocked out of whack. The chart on *page 79* lists the specific stops for each planer. Ridgid offers the most stops, with eight at common thicknesses, but two tested models—the Delta 22-580 and Makita—have single stops that can be set to virtually any thickness. Although we appreciate the versatility of these systems, each has its drawbacks: We found Delta's stop clumsy to engage; and Makita uses a quick-release stop rod (such as you might find on a drill press or plunge router) but there's no scale to tell the thickness.

Two features that separate these machines...

■ ***Knife-changing ease.*** The days of fumbling with a blade-height gauge while tightening gib screws on your benchtop planer are gone—almost. Except for the Grizzly, which still uses that system and resharpenable knives, all of the tested planers employ self-indexing, double-edge, disposable knives for fast, foolproof changes. After a practice run to get familiar with each planer, it took us from 7 minutes (Delta 22-580) to 16 minutes (Grizzly) to change knives, with the majority of the rest taking from 9 to 11 minutes.

Besides self-indexing knives, the two biggest factors that speed knife changes are a self-locking cutterhead that prevents the head from rotating while working with the gib screws (all but the Delta TP305 and Grizzly have one), and wide-open access to the cutterhead, such as on the DeWalt DW735 (*below*) and Ridgid.

■ ***Dust collection.*** The DeWalt DW735 boosts dust collection with an internal blower that actively sucks chips away from the cutterhead. By connecting the narrow end of an optional half-bag filter to its 4" dust port and the wide end over a trash can, this machine collects its own waste, eliminating the need for a dust collector.

Most of the dust hoods, whether standard or optional accessories, connect easily to a 4" dust hose. Ridgid will accept both 4" and 2½" hoses (for shop-vacuum connection), and Ryobi's port (shown *opposite, bottom*) fits 2½" hoses. The outlet on Makita's optional hood measures 3" and requires adapting for either common hose size.

...And two that don't

■ ***Power.*** We measured the power of each planer with an in-line ammeter while making a 1/32"-deep cut in 11"-wide red oak. To our surprise, all of the machines, regardless of price, demonstrated about equal power during this hefty cut.

■ ***Noise.*** All of the planers exceeded the 85-decibel (dB) limit that can cause hearing damage. In fact, noise levels of these machines range from 98dB (about the same as a diesel truck from 30' away) to 103dB (a power mower at 3' distance). Bottom line: Some are louder than others, but all require hearing protection.

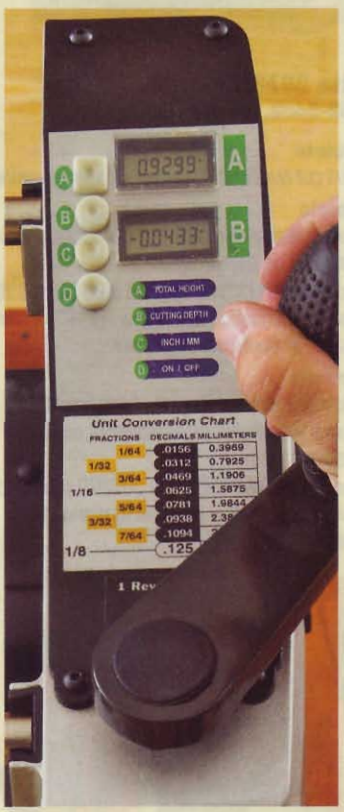
AMPLE BLADE-CHANGING ROOM

The entire top of the DeWalt DW735 comes off to provide plenty of working room when changing knives. The same T-wrench drives the gib screws and removes the cover.

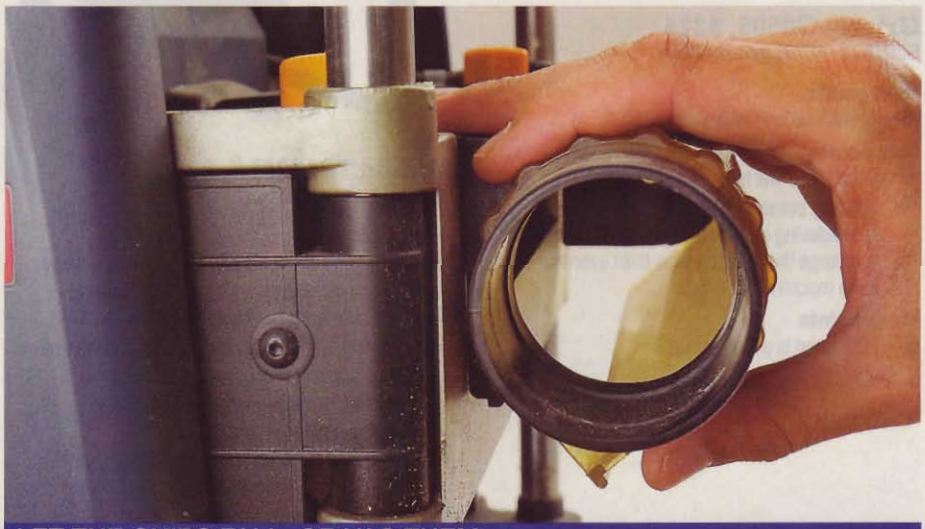
Meet the planers

Two to come from Craftsman

Within the next few months, you'll see a couple of new benchtop planers on the shelf at Sears. We couldn't get either of the units in time to test for this article, but we'll tell you how they perform after our tests are completed. George Gibson from Craftsman (800/377-7414, craftsman.com) told us the 21759 13" planer (shown *below*) will sport dual feed speeds and a three-knife cutterhead, like the DeWalt DW735. It also provides the effective blower-assisted dust collection we've enjoyed on recent Craftsman planers. But the really hot feature—especially for those of us who don't see as well as we used to—is an easy-to-read digital display that shows cutterhead height and material removal, as shown at *left*. The 21759 will sell for $500 when it debuts early next year.



At the other end of the price scale, Craftsman's new 12½" planer (21758) offers fewer features but includes extension tables and a 2½" dust port that ejects chips to either the left or the right. It costs $250, and should be available by the time you read this.



LET THE CHIPS FALL, OR VAC THEM

Turn Ryobi's convertible dust hood counterclockwise, and the chips will shoot straight out the back of the machine. When you rotate the port clockwise, the hood directs debris out through the 2½" vacuum port.

Delta TP305, $200

800/223-7278, deltamachinery.com

High points

- Leaves a surface as smooth as some planers that cost twice as much.

Low points

- Deep snipe will have to be cut off.
- This bare-bones unit lacks thickness stops and a material-removal gauge, and the cutterhead doesn't lock automatically when changing knives.

More points

- Optional dust hood costs $25.

Delta 22-580, $420

800/223-7278, deltamachinery.com

High points

- This planer scored well in most of our performance categories, including cut quality and lack of snipe.
- Thickness stop can be set at any height from ⅛" to 6½".

Low points

- The 22-580's "blade zero" indicator, which is supposed to tell when the cutterhead height matches stock thickness, varied by as much as 1/64" in our tests.
- The full-range thickness stop lacks the reliable repeatability of dedicated thickness stops. It's also clumsy to engage.

More points

- Optional dust hood ($25) can direct debris to either the left or right of the machine.

DeWalt DW734, $380

800/433-9258, dewalt.com

High points

- The three-knife cutterhead produces very good cut quality.
- A dust-collection hood comes with this planer, and it proved effective.
- Widely spaced markings on the material-removal gauge make it easy to eyeball small adjustments.

Low points

- We found the thickness scale somewhat difficult to read: Its markings are close together, and the cursor stands away from the scale.

Jet JWP13DX, $420

800/274-6848, wmhtoolgroup.com

High points

- A 37½" table length contributes to the above-average cut quality and lowest snipe in the test.
- The cutterhead height-adjustment crank can be switched to either the left or right side of the planer to suit your preference.

Low points

- Cutterhead locking lever is short and hard to get hold of.

More points

- The JWP13DX is a good, solid planer, but there are others in the test that provide more bang for the buck.

Makita 2012NB, $460

800/462-5482, makitatools.com

High points

- Good cut quality includes about average snipe.

Low points

- Crude material-removal "gauge" lacks a scale to show cutting depth.
- Odd-size port (3") on optional dust hood ($30) requires adaptation to fit either a 2½" vacuum hose or 4" dust-collection hose.

More points

- Thickness stop can be set at any height, but it lacks the reliable repeatability of dedicated thickness stops.
- Like the Jet JWP13DX, the 2012NB proved to have middle-of-the-pack performance for a premium price.

DeWalt DW735, $500

800/433-9258, dewalt.com

High points

- Three-knife cutterhead and two feed speeds combine for the best cut quality in the test.
- Large, side-mounted crank makes changing the cutterhead height comfortable and smooth.
- All markings, from thickness scale to material-removal gauge to thickness stops, are large and easy to read.
- Top comes off to provide wide-open access when changing knives.
- Blower-assisted dust collection works with optional half-bag filter and improves efficiency of whatever dust collector it's connected to.

Low points

- Extension tables cost $45, and are necessary to minimize snipe.

More points

- If you want a planer to deliver a smooth surface at all costs, the DW735 is your tool.

Grizzly G0505, $225

800/523-4777, grizzly.com

High points

- It ranks second lowest in cost.

Low points

- Deep snipe will have to be cut off.
- The only planer in the test group without self-indexing disposable knives. It took longer to change these two knives than even the three-knife machine.

More points

- Dust hood is a $16 option.

Ridgid TP1300LS, $380

800/474-3443, ridgid.com

High points

- Very good cut quality includes average snipe.
- All of the controls are easily accessible and readable from the right side of the machine.
- The top of the planer pops off easily for wide-open access when changing knives.
- Its eight thickness stops—from ⅛" to 1¾"—rank the most in the test.
- The middling price tag includes many extras, including the dual-port (2½" and 4") dust hood, a sturdy steel leg stand, and an extra set of knives, making the TP1300LS a Top Value.

WOOD MAGAZINE TOP VALUE APPROVED

Ryobi AP1301, $200
800/525-2579, ryobitools.com

High points

- Cut quality from this bare-bones machine is on par with planers costing $150–$180 more.
- Dust hood can spew chips out the back of the planer or route them to its 2½" port with a flick of the wrist.

Low points

- With the deepest snipe in the test (you'll need to cut it off), there's no way to improve it because Ryobi doesn't offer extension tables.

More points

- If you don't mind cutting off the sniped ends, this $200 tool delivers very good cut quality at a rock-bottom price, making it a Top Value.

We'd want these planers with us through thin and thinner

Both the DeWalt DW735 and Delta 22-580 performed well in our tests, and we'd be pleased to have either one in our shop. Both have their Achilles' heels, though: On Delta, it's the clumsy thickness stop and hit-or-miss depth-of-cut gauge. With the DW735, you have to buy accessory extension tables ($45), or it snipes like a $200 planer. But we'll give the DW735 the Top Tool nod—by a nose—based on its superior cut quality.

Our Top Value choices were a bit easier. The Ridgid TP1300LS and Ryobi AP1301 left surfaces as smooth as the Delta 22-580. Ridgid does it for $40 less than the 22-580, and the TP1300LS also comes with extra knives, a leg stand, and dust hood. The bottom-dollar Ryobi planer costs $150 less than either of those models, but plan to cut off the sniped ends or build your own infeed and outfeed tables.

Written by **Dave Campbell** with **Pat Lowry**

See more tool reviews at **woodmagazine.com/reviews**

PERFORMANCE GRADES FOR A PARADE OF PLANERS

BRAND	MODEL	MATERIAL FEED RATE (FPM) (1)	CUTS PER INCH (1)	CAPACITIES (INCHES)(2) MAXIMUM WIDTH	MINIMUM THICKNESS	MAXIMUM THICKNESS	5½"-WIDE WORKPIECE	FULL WIDTH	MAX. DEPTH OF CUT (INCHES) (2) TABLE LENGTH WITH EXTENSIONS (INCHES) (3)	BLADE STYLE (4)	THICKNESS STOPS (INCHES) (5)	PERFORMANCE GRADES (6) HEAD LOCK (Yes/No)	CUT QUALITY (7)	LACK OF SNIPE (8)	HEIGHT-SCALE READABILITY	EASE OF KNIFE CHANGING	THICKNESS STOP, EASE OF USE (5)	DEPTH-OF-CUT GAUGE, EASE OF USE (5)	NOISE LEVEL (dB) (9)	CORD LENGTH	ACCESSORIES (10) STANDARD	OPTIONAL	DUST HOOD COST (11)	WARRANTY (YEARS)	COUNTRY OF ASSEMBLY (12)	WEIGHT (POUNDS)	SELLING PRICE (13)
DELTA	22-580	20/30*	90/60*	13	1/8	6½	1/8	1/16	35⅛	D	continuous	Y	A-	A-	A-	A-	B	C	102	6	T	D,K	$25	2	T	97	$420
	TP305	26.2	51	12½	3/16	6	3/32	3/64	26	D	N/A	N	B+	C	B-	B+	N/A	N/A	99	6	T	D,K,S	25	2	C	62	200
DEWALT	DW734	26	96	12½	1/8	6	1/8	1/16	33⅛	D	¼,½,¾	Y	A-	B+	B-	B+	B-	B	103	7	D,T	K	—	1	T	80	380
	DW735	14/26*	179/96*	13	1/8	6	1/8	1/16	37¾*	D	⅛,¼,½,¾,1,1¼	Y	A	B*	B+	A	A	A-	102	7½	D	H,K,T	—	1	T	92	500
GRIZZLY	G0505	32	52	12½	13/64	6	3/32	1/16	27⅛	R	N/A	N	C	C	B	C	N/A	N/A	101	7	T	D,K	16	1	C	71	225
JET	JWP13DX	18/26*	74/51*	13	1/8	6	1/8	1/16	37½	D	⅛,⅜,½,¾,1,1¼	Y	B	A	B	B	B-	B	102	8½	T	D,K	37	1	T	77	420
MAKITA	2012NB	28	51	12	7/64	6 3/32	1/8	3/64	30¼	D	continuous	Y	B+	B	B-	B-	C	B	100	7½	T	D,K,S	30	1	C	61	450
RIDGID	TP1300LS	26	61	13	9/64	6	1/8	3/32	33¾	D	⅛,¼,½,¾,1,1¼,1½,1¾	Y	A-	B	B+	A-	A-	A-	98	10	D,K,S,T		—	3	T	85	380
RYOBI	AP1301	26	58	13	1/8	6	1/8	1/16	14	D	N/A	N	A-	D	B-	B-	N/A	N/A	101	6	D		—	2	C	53	200

NOTES:

1. (*) Finishing mode/dimensioning mode
2. Spec from manufacturer.
3. (*) With optional extension tables; 19¾" without optional extensions.
4. (D) Self-indexing disposable
   (R) Non-indexed resharpenable
5. "Continuous" means stop can be set at any height.
   (N/A) Planer lacks this feature.
6. A Excellent
   B Good
   C Fair
   D Poor
7. Multi-speed units tested in finishing mode.
8. After adjustments.
   (*) With optional extension tables. Without tables, grade is C.
9. Measured 12" above table and 24" in front of planer running under no load.
10. (D) Dust-collection hood
    (H) Half-bag trash can collector
    (K) Extra knives
    (S) Stand
    (T) Infeed/outfeed tables
11. (—) Dust hood included with planer.
12. (C) China
    (T) Taiwan
13. Prices current at time of article's production and do not include shipping, where applicable.

get the most from your planer

Make your planer more effective at doing its main job—planing boards to thickness—and multiply its usefulness by putting it to work in ways you might never have considered before.

The planer has no equal when it comes to dimensioning lumber to thickness. However, many people fail to realize this machine's full potential beyond mere thicknessing. Planers also safely machine small or warped pieces with the use of helpful jigs, mill boards to final width, and create smooth tapers.

Set up your planer for optimum results

Regardless of what type or size of lumber you're running through your planer, apply these tips to not only get better performance from the machine, but also save yourself work later by heading off pesky problems before they happen.

- Perform routine maintenance (see Tool Shop, *page 37*) on your planer to keep it in top operating condition.
- Always use a dust-collection system to clear chips and dust. Without one, debris can dimple your workpieces, as shown at *right*. When using a central system, close the blast gates on all other tools for maximum suction. If you use a shop vacuum, check the

DIMPLES AREN'T CUTE ON WOOD

Feed roller pressure creates "dimples" (shown here as light spots on walnut) by pressing stray chips into the surface.

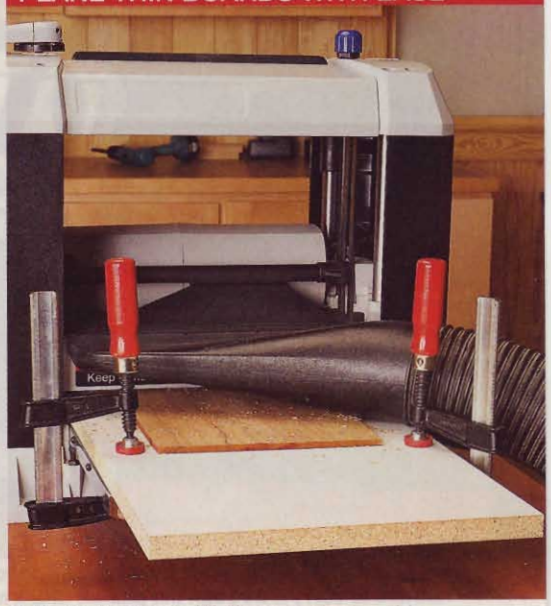
VEER FROM THE STRAIGHT PATH

Feeding boards at a slight angle not only reduces surface chip-out, but also helps limit any snipe to one corner.

MAKE A BOARD TRAIN

Planing boards end to end keeps the feed rollers at a consistent height, taking away the chance for snipe.

PLANE THIN BOARDS WITH EASE



Take shallow cuts (1/64") when planing thin stock, so you don't accidentally shatter the workpiece.

filter frequently because dust quickly plugs it, reduces suction, and stresses the motor.

- Use compressed air to blow out leftover chips and debris that cling to the feed rollers. This, too, reduces dimples. Also, rubber feed rollers don't grip workpieces as well when they're covered in dust, oftentimes causing boards to stall inside the planer.
- Once you determine the best feed direction for a board—the one that leaves the smoothest surface—mark it so you don't have to check the grain each time. Use an arrow on the edge, or mark the end grain.
- Always flatten one face of a board on the jointer before thickness-planing the opposing face. Remember, a planer will not flatten a board, only make the faces parallel.
- Alternately machine each face of a board, taking shallow cuts (1/32" or less). Removing more material from one face than the other could lead to warping.
- Run boards through the planer slightly askew to reduce chip-out, as shown *above*.
- Get maximum life from planer knives by spreading your work across the entire width of the machine. Running most of your boards in the middle results in greater knife wear there than on the ends.

Beat snipe by taking away its root causes

Snipe is the sunburn of woodworking: You can take steps to prevent it, but once it happens you're forced to deal with it. Snipe (scooplike depressions on the first and last couple of inches of a board) might even seem undetectable, but it will reveal itself when you apply stain or a light-reflecting finish. Sanding or hand-scraping proves the best way to remove shallow snipe. Or, cut workpieces 3–4" longer than needed to allow for it, and then cut off the sniped ends.

But, you can prevent or reduce snipe with a few simple steps. First, set the ends of your planer's infeed and outfeed tables 1/16" (about the thickness of a penny) higher than the planer table. If your planer is not equipped with infeed and outfeed tables, make your own supports from melamine, MDF, or plywood with the ends set a little higher. Or, lift slightly (about 1/8–1/4") on the outfeed end of a board just as the infeed roller releases it.

Feed a board at a sharp angle; then straighten it somewhat after a couple of seconds. This only works, however, on benchtop planers with rubber feed rollers. Stationary models with steel rollers will not allow you to straighten a board once it starts feeding.

Finally, feed boards butted end to end like a train, as shown *above*, to maintain feed roller down pressure. Use scrap pieces to lead the first board and follow the last.

Use carriers for thin, short, or warped stock

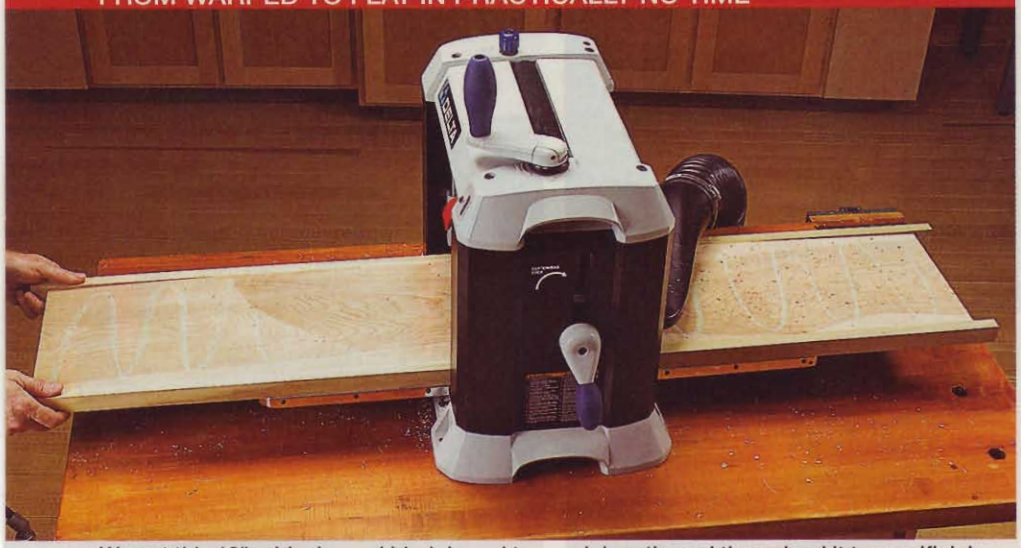
If you want to plane a workpiece to a thickness less than 1/4", you'll get the best results by using an auxiliary bed. Although most planers indicate they will cut to 1/8" thick, don't try it: You risk deep snipe and chatter marks. Instead, place a 3'-long piece of melamine through the planer, and clamp it to the infeed and outfeed tables. Then plane your stock to thickness as usual, as shown *above*. To plane a short board thin, double-face tape it to a 15"-long piece of 3/4" plywood, MDF, or particleboard. This allows the workpiece to ride piggyback through the planer.

Because most planers won't safely and accurately machine single workpieces shorter than 12", use special runners when you need to plane a board that short, as shown *below*. To do this, glue sacrificial runners—at least 12" long and slightly

RUNNERS SECURE SHORT STOCK

Scrapwood runners help you get use from cutoffs, like this 8" piece of leopardwood.

FROM WARPED TO FLAT IN PRACTICALLY NO TIME



We cut this 10"-wide, bowed birch board to rough length, and then glued it to sacrificial runners to carry it through the planer. Chalk marks vanish when the face is flat.

GROUP BOARDS FOR STABILITY

Squeeze boards together on the infeed and outfeed sides when edge-planing.

thicker than the workpiece—to your stock's edges. Be certain to glue the carriers parallel to each other so they will maintain equal contact with the feed rollers. Wipe away glue squeeze-out that will nick the knives. Once you've milled your board to the desired thickness, rip away the runners on the tablesaw.

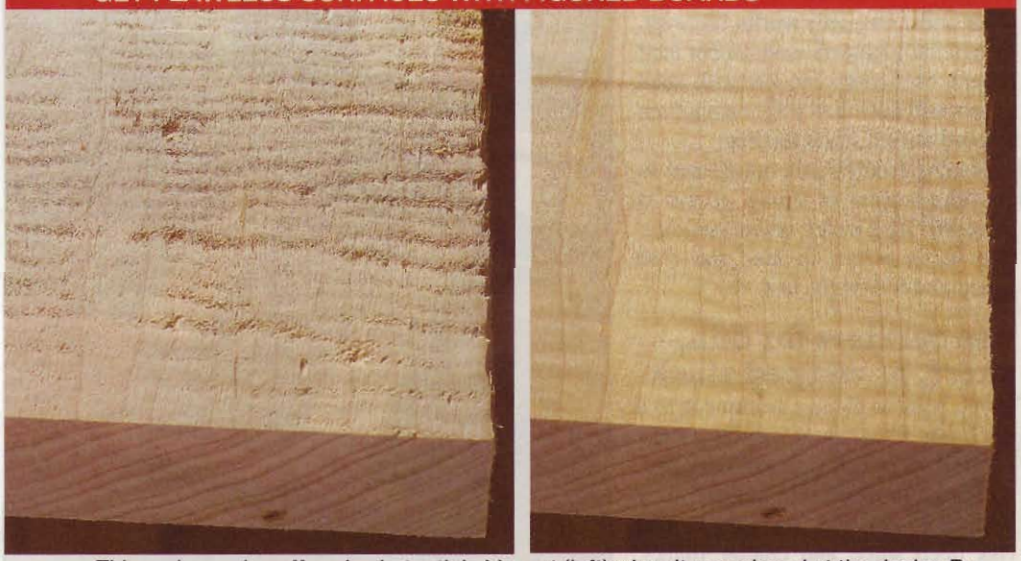
You can use this same technique to remove a bow, cup, or twist from stock too wide for your jointer. First, machine straight edges on the warped board at your jointer or tablesaw. Next, glue runners to the workpiece edges. When assembled, these runners must be taller than the board's warp and parallel with each other. To ensure they're parallel, make certain the runners rest on your bar, pipe, or parallel-jaw clamps, which must be sitting on a flat worksurface. After the glue dries, plane one face flat, as shown *above*. Then rip away the runners at the tablesaw, and plane the opposing face to the desired thickness.

Take it easy when planing figured wood

To successfully plane highly figured or tear-out-prone woods, such as curly or bird's-eye maple or quilted mahogany, try the following tips:

- Don't let grain orientation deceive you. If you can't determine the direction, make your best guess. Figured wood typically has been planed by the dealer, so look for chip-out from that before planing it yourself. If you guessed wrong, turn the board around and try again. (See photos *below left.*)
- Change or sharpen your knives. Fresh, sharp knives slice wood rather than the tearing action of dull knives, as shown on the *top of next page.*
- Take shallow cuts (1/64") to avoid tearing out deep chips.
- Use the slower feed rate if you're using a two-speed planer.
- Don't bother to mist figured wood with water before planing; in our tests it didn't reduce chip-out.

GET FLAWLESS SURFACES WITH FIGURED BOARDS



This curly maple suffered substantial chip-out (left) when it was planed at the dealer. By using sharp planer knives, a slower feed rate, and 1/64" cuts we produced a smooth surface with striking figure (right).

Get perfect widths by edge-planing boards

Yes, a planer will machine workpieces narrower than 6" set on their edges. The planer also machines to a consistent width throughout the cut with steady roller pressure, whereas hand pressure can allow a board to raise up slightly on a jointer—and you might not know it.

To plane the edge, a board must be square and true on all four sides, but slightly wider than finished width. If the workpieces are *not exactly the same width, narrower boards* (especially in the middle of three or more boards) can be kicked out by the planer. You can plane single boards or multiple boards at the same time, which helps them maintain a 90° angle, as shown *above.*

Although you can plane a 3/4"-thick board on edge by itself, we don't recommend it—especially with boards 4–6" wide—because they can tilt a little, resulting in unsquare edges. Instead, run single boards through the planer with the help of a jig that holds them at 90°. You can use a jig with supports

DON'T LET DULL KNIVES DAMAGE YOUR BOARDS

Worn and nicked planer knives couldn't do justice to this mahogany, which had multidirectional grain at opposing ends that was difficult to read. After changing knives and making several passes with light cuts, we revealed a board with beautiful cathedral grain.

clamped only to the infeed side, as shown on *page 80*, or you can use one with continuous supports that reach through the planer and clamp to both extension tables, as shown at *right*. The latter offers your boards support throughout the cut, but also loses cutting height equal to the thickness of your jig base (¾" with our jig). To build these jigs see woodmagazine.com/planerjig.

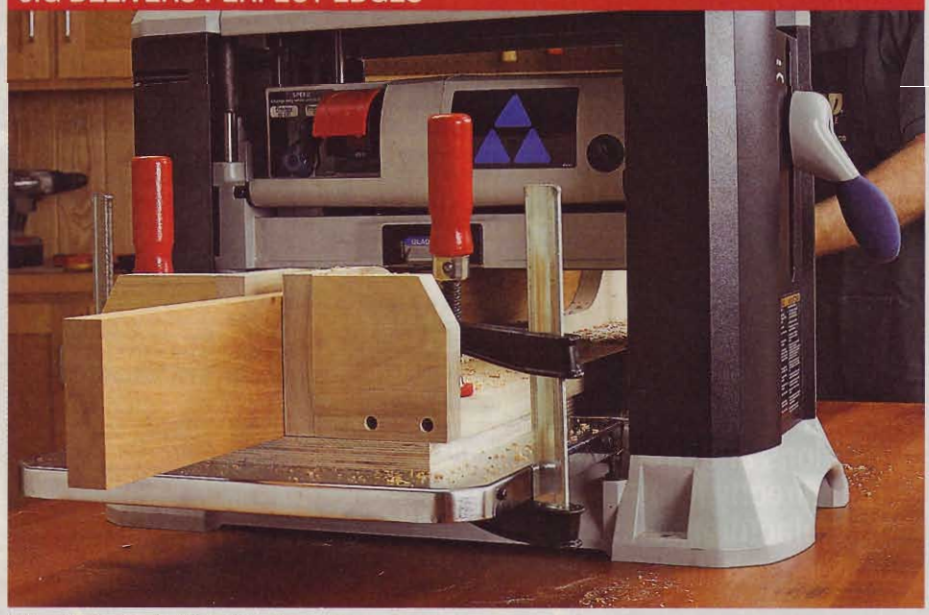
Create smooth tapers with a planer jig

You can cut tapers (on table legs, for example) on a tablesaw with a jig or freehand on a bandsaw, but neither will give you the smooth finish that a planer will. Build the jig to match the exact taper you want. Lay out the taper on one leg face. With the top of the leg resting on the jig's base and against the stopblock, raise the bottom of the leg until the taper line parallels the jig base. It will be parallel when the distance from the base to the line is equal at both ends. Make the bottom spacer the exact height that holds the taper line parallel. Add spacers—one per foot of length will suffice—below the workpiece to keep it from bowing under the down pressure of the feed rollers.

Cut away most of the waste from the leg at the bandsaw, and then position it between the stopblocks on the sled with the tapered face up. Feed the top of the leg into the planer first, as shown at *right*, to avoid tear-out at the exit point. You can taper two faces of a leg in this manner, as long as they're perpendicular to each other, because you need an untapered face resting on the spacers. To taper the remaining faces, make and install a second set of taller spacer blocks that make the remaining layout lines parallel to the base. Then repeat the machining steps.

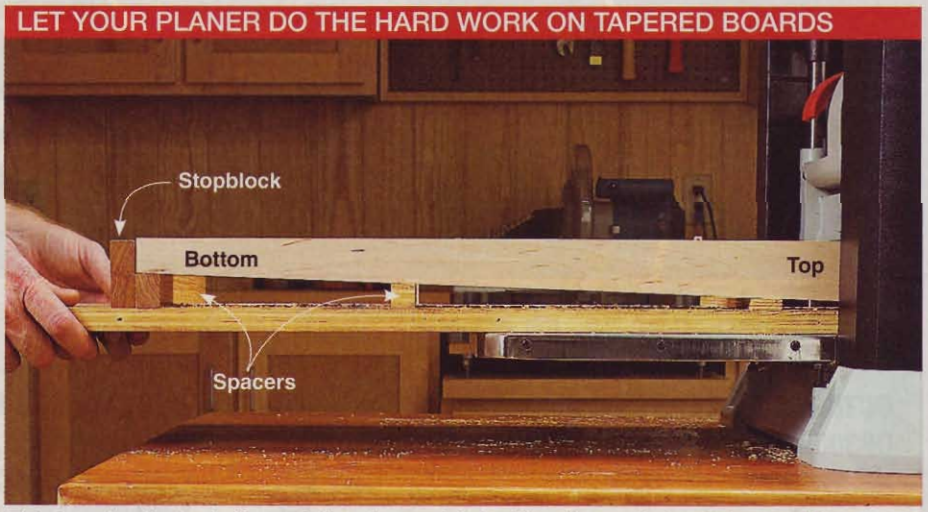
Written by **Bob Hunter** with **Chuck Hedlund**

JIG DELIVERS PERFECT EDGES



This shop-made jig holds stock at a right angle as it feeds through the planer. However, maximum cutting height will be reduced by the thickness of the jig's base.

LET YOUR PLANER DO THE HARD WORK ON TAPERED BOARDS



This tapering jig feeds through the planer while holding the workpiece's tapered face parallel to the feed rollers and cutterhead.

Better Homes and Gardens®
WOOD® PATTERNS®
November 2006 *Issue 173*

Dear Reader: As a service to you, we've included full-size patterns on this insert for irregular shaped and intricate project parts. You can machine all other project parts using the Materials List and the drawings accompanying the project you're building.

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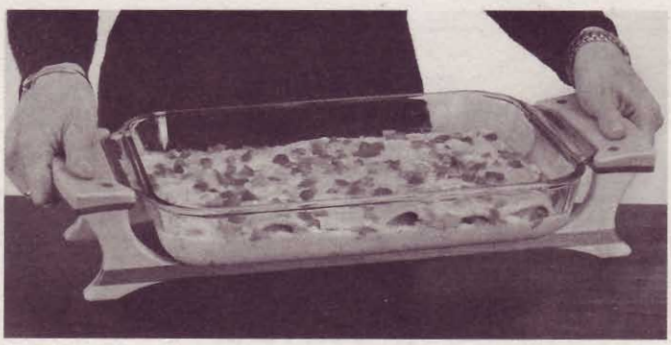
Fibonacci gauge, Page 13
Hot-dish holder, Page 40
Kaleidoscope, Page 90

Fibonacci gauge, Page 13

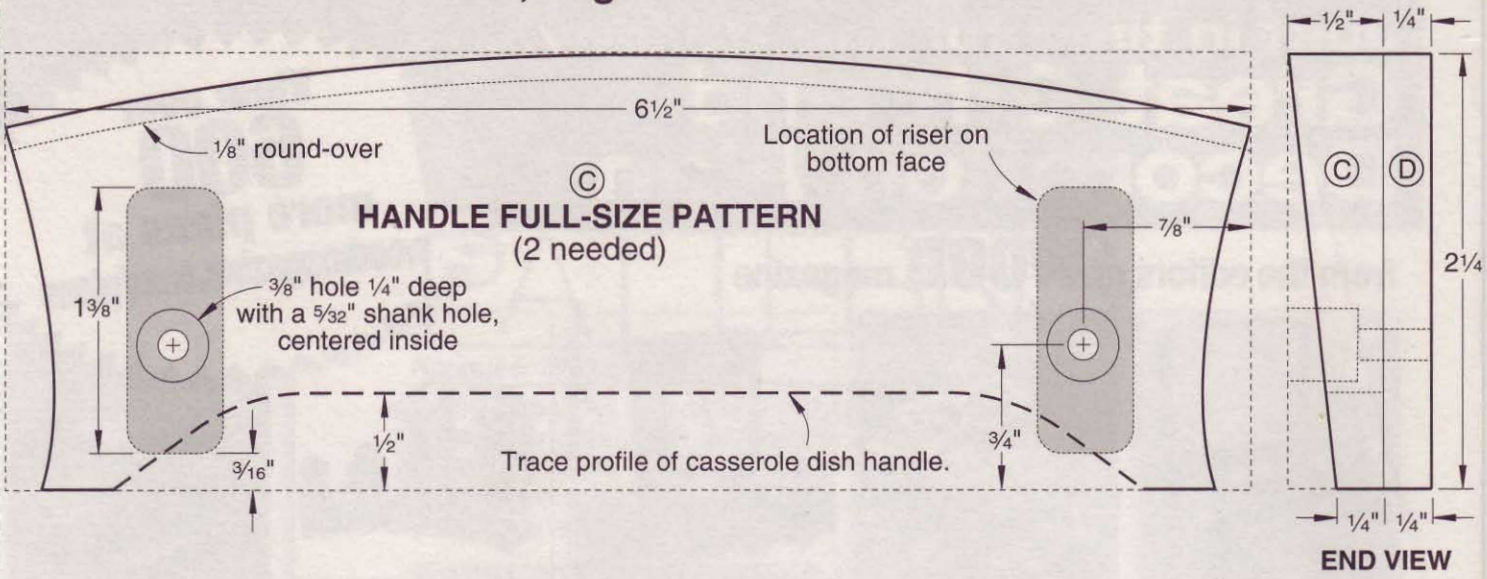


Hot-dish holder, Page 40

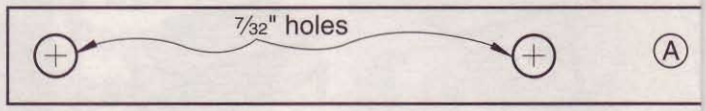
Kaleidoscope, Page 90

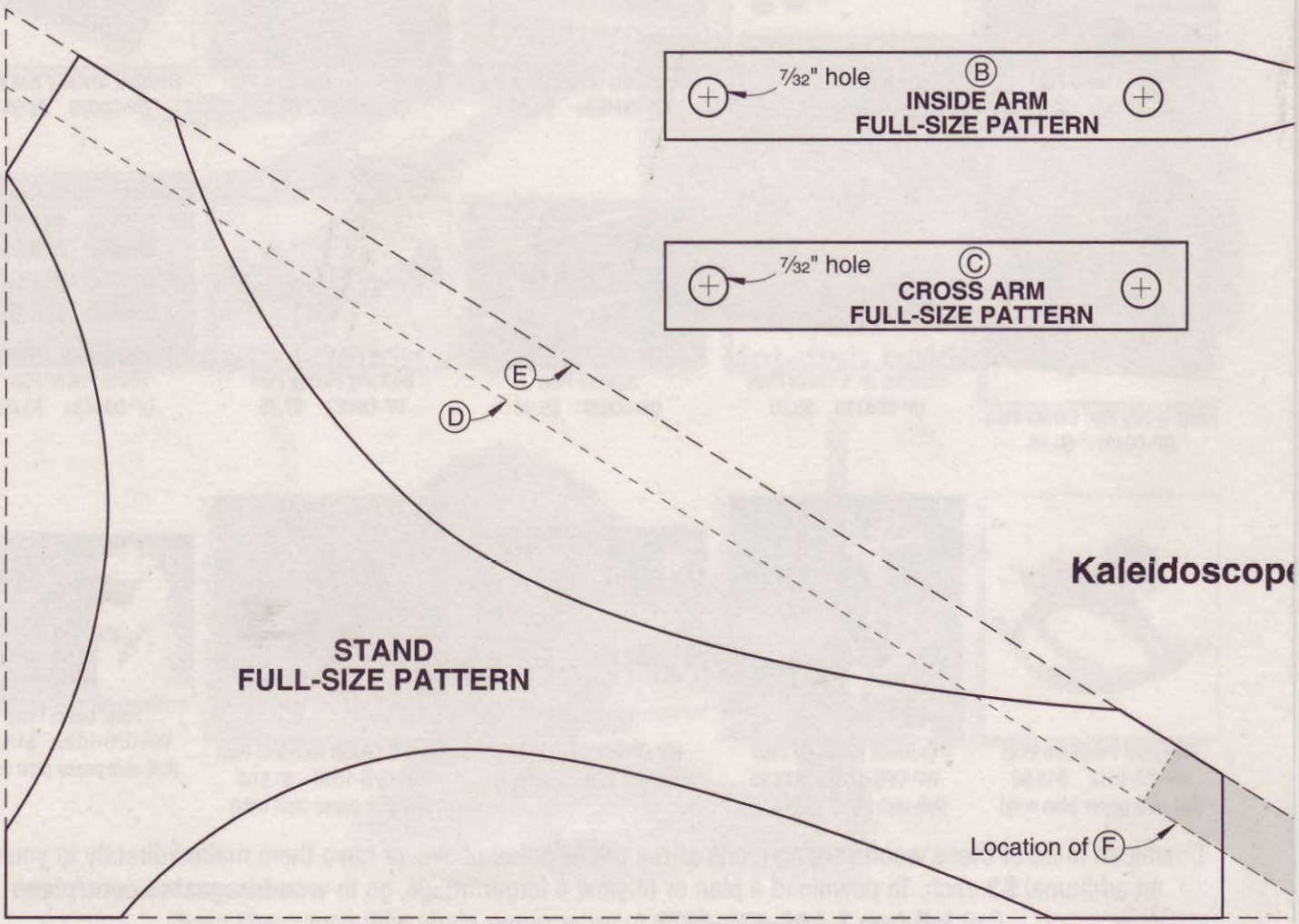
Remove at perforation

Hot-dish holder, Page 40

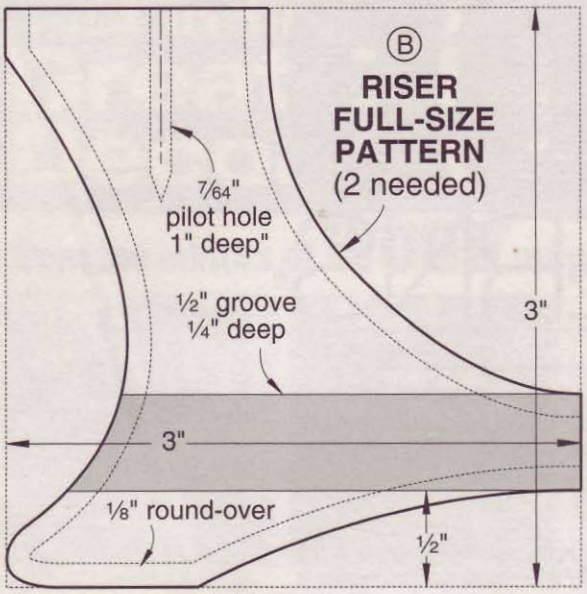


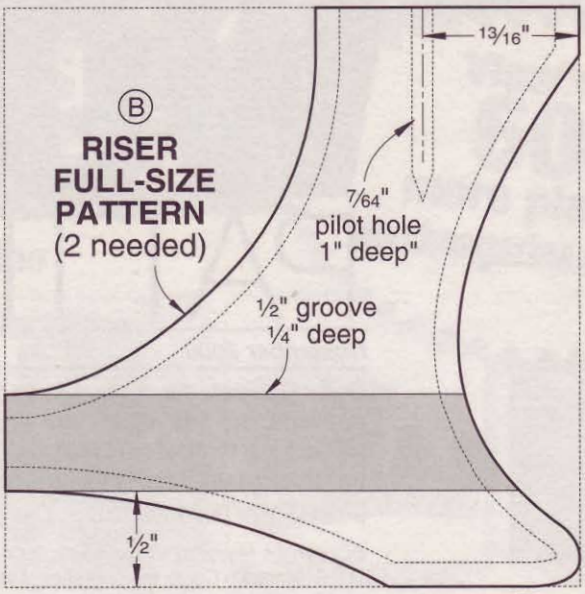
Fibonacci Gauge, Page 13

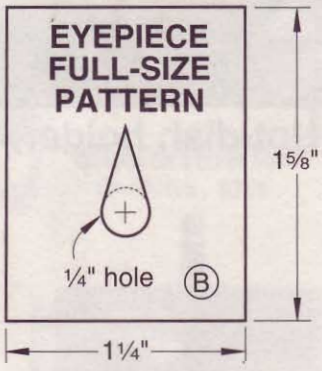


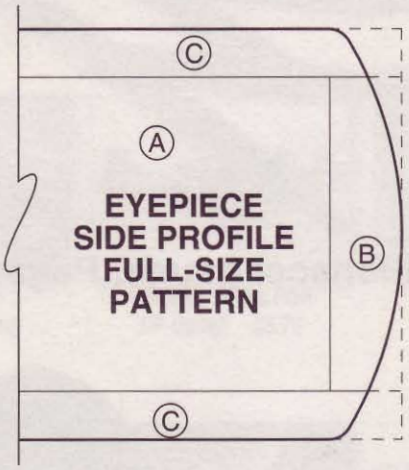


Kaleidoscope

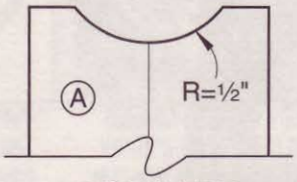




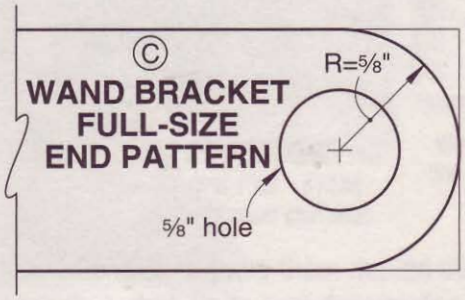




e, Page 90



BODY END
FULL-SIZE PATTERN



magic wand kaleidoscope

Three mirrors multiply a stream of stars, moons, and planets into an ever-changing visual delight.

Included are plans for an optional display stand.

Start by gathering a few scraps of contrasting figured woods. Follow with simple construction, and you'll have an heirloom toy for kids of all ages.

Build the tube

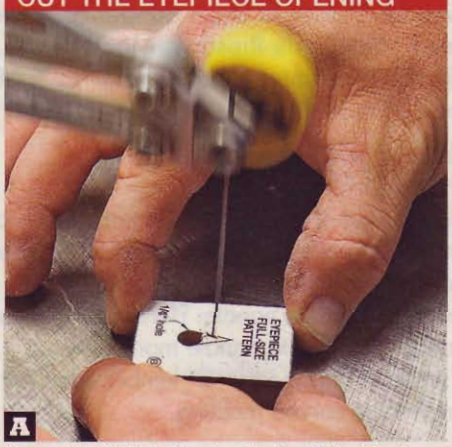
1 For the body (A), plane stock to ⅝" thick and cut two 1⅝×9" pieces. Then form U-shaped channels from these pieces [**Drawing 1**, **Steps 1** and **2**]. Now glue and clamp the channels together to form a square tube. Keep the ends and edges flush and remove excess glue from the inside and outside. Trimming both ends, cut the body to 8⅛" long.

2 Photocopy the **Body End Pattern** on the *WOOD Patterns*® insert. Cut out the pattern and adhere it with spray adhesive to one end of the body (A), flush at the end and edges. Then bandsaw and sand the body to the pattern line.

3 Plane stock to ⅜" thick, and cut a 1¼×12" blank for the eyepiece (B). Then cut the eyepiece to length. Photocopy the **Eyepiece Pattern** on the insert, and adhere it to the eyepiece. Using a ¼" brad-point bit, drill a hole where indicated on the pattern, and scrollsaw the opening to shape [**Photo A**]. Glue and clamp the eyepiece to the body [**Drawing 2**], keeping the edges flush.

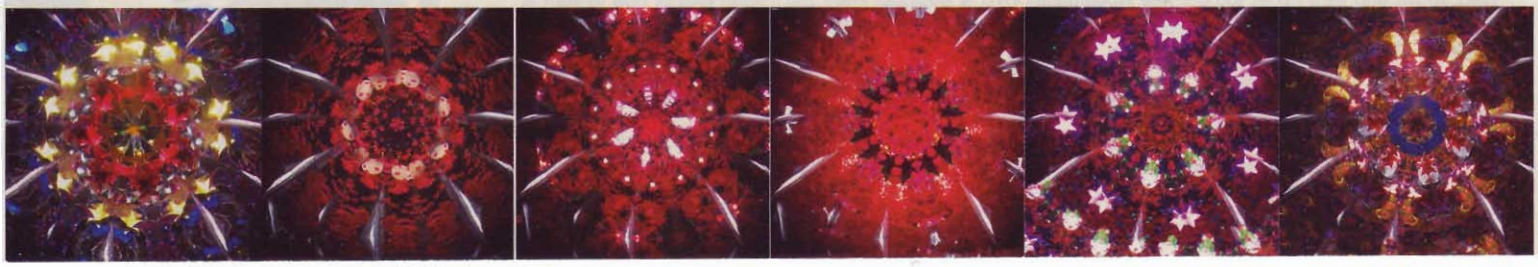
4 Resaw and plane stock to ¼" thick for the wand brackets (C), and cut them to size. Adhere the brackets face-to-face with double-faced tape, keeping the ends and edges flush. Then photocopy the **Wand Bracket Pattern** on the insert, and adhere it

CUT THE EYEPIECE OPENING



A

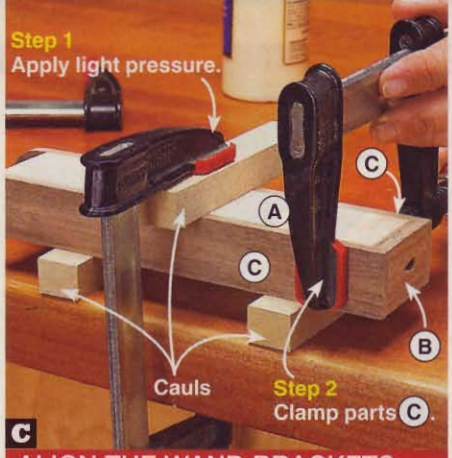
Using the ¼" blade start hole drilled in the eyepiece, cut the teardrop opening with a scrollsaw and a no. 2 reverse-tooth blade.



B

FORM WAND BRACKET ENDS

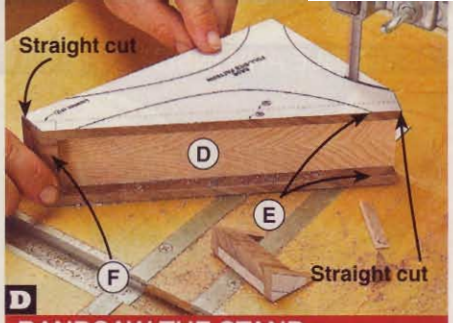
With the wand brackets (C) adhered face-to-face with double-faced tape, disc-sand the parts to the pattern line.



C

ALIGN THE WAND BRACKETS

To keep the wand brackets (C) flush with the body (A), apply light clamp pressure to the cauls. Then clamp the brackets.

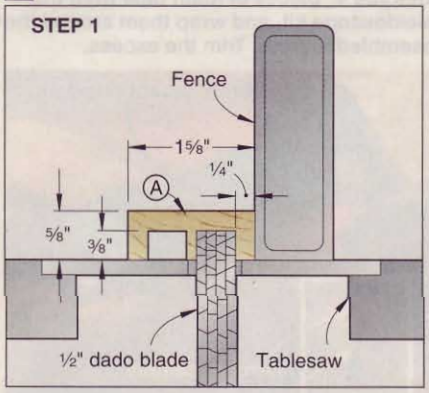


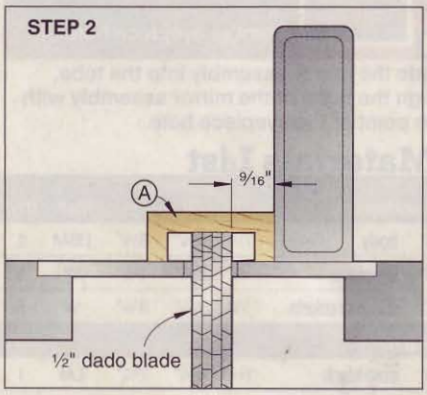
D

BANDSAW THE STAND

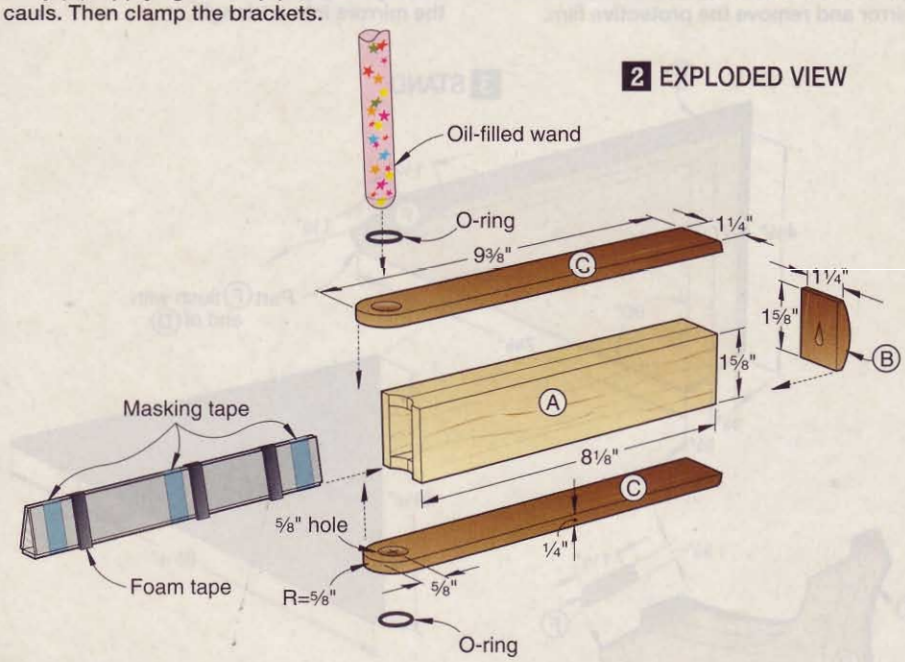
Bandsaw the two straight cuts, and then cut the curves. Stay slightly to the waste side of the pattern lines.

1 FORMING THE BODY





2 EXPLODED VIEW



to the top bracket, flush with one end. Chuck a ⅝" Forstner bit into your drill press, and drill a hole through both brackets, where indicated on the pattern. Now disc-sand the end radius [**Photo B**]. Separate the parts.

5 Glue and clamp the wand brackets (C) to the body/eyepiece assembly (A/B), keeping the bracket ends flush with the eyepiece (B) and edges flush with the body (A) [**Photo C**]. Photocopy the **Eyepiece Side Profile** on the insert, and adhere it to the tube assembly (A/B/C), flush with the eyepiece outer face and wand bracket edges. Disc-sand the eyepiece and the wand bracket ends to shape. Finish-sand the tube.

Make the optional stand

1 For the core (D), cut a ¾×6×8" piece of stock diagonally and laminate the two pieces of stock, keeping the end and edges flush. With the glue dry, joint the edge and crosscut the end of the laminated blank. Then lay out the triangle shape [**Drawing 3**]. Bandsaw to the layout line and sand the edge smooth.

2 Resaw and plane stock to ¼" thick, and cut two 5½×8½" blanks for the sides (E). Adhere the blanks face-to-face with double-faced tape. Then joint one edge and and crosscut one end of the joined blanks, lay out the triangle shape [**Drawing 3**], and bandsaw and sand them, as you did for the core (D). Now separate the blanks, and glue and clamp them to the core, keeping the jointed and crosscut edges flush.

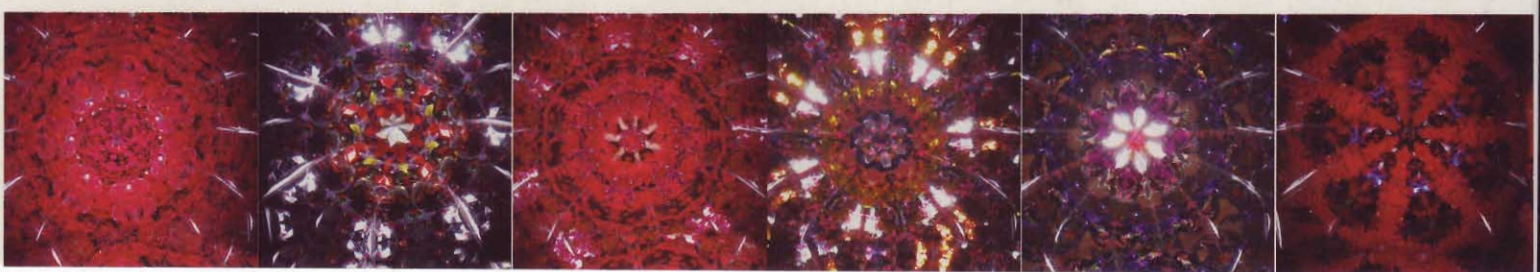
3 From a planed piece of ⅜"-thick stock, cut a piece to 1½" wide × 1¼" long for the cleat (F). Glue and clamp it to the core (D), flush at the "toe" end [**Drawing 3**].

4 Photocopy the **Stand Pattern** on the insert, and adhere it to the laminated stand blank (D/E/F). Then cut it to shape [**Photo D**]. Disc-sand the straight cuts, and drum-sand the curves to the pattern line. Finish-sand the stand.

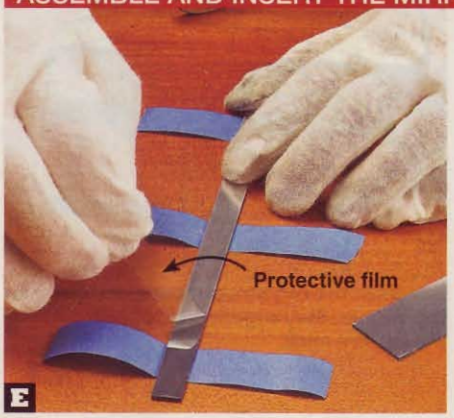
Finish and assemble

1 Examine the kaleidoscope tube and stand and finish-sand where needed. Then apply a clear finish. (We applied two coats of satin polyurethane, sanding with 220-grit sandpaper between coats.)

2 Before assembling the triangular mirror, make sure your work surface is clean.



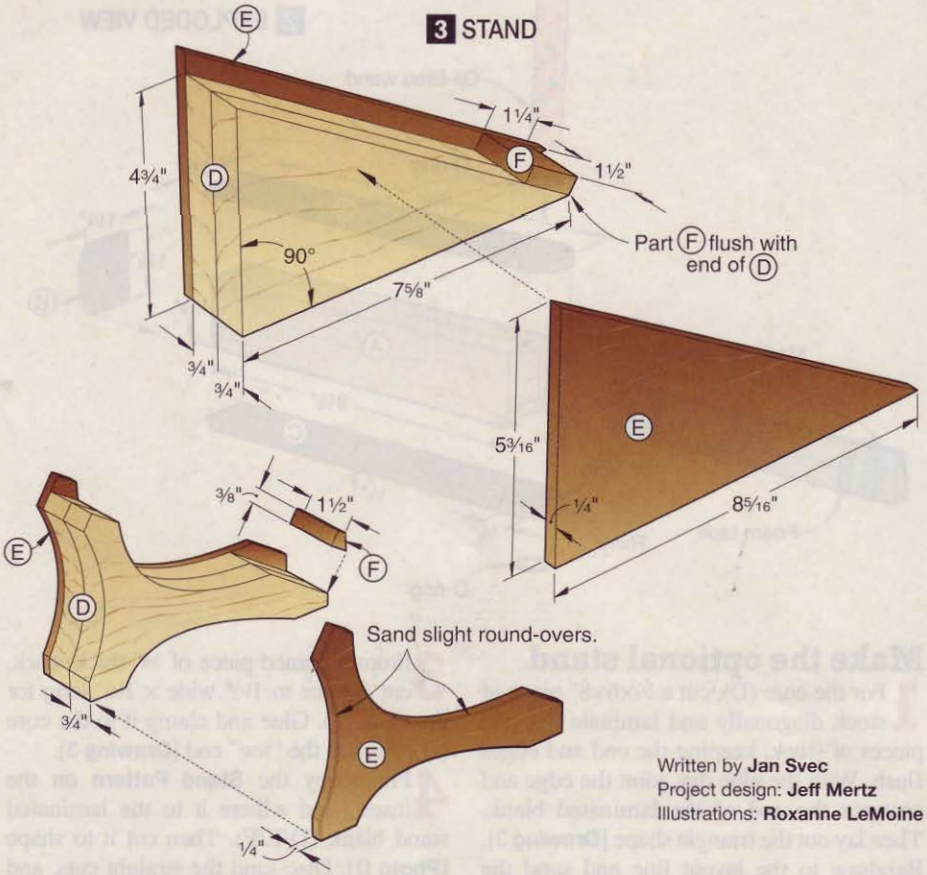
ASSEMBLE AND INSERT THE MIRROR

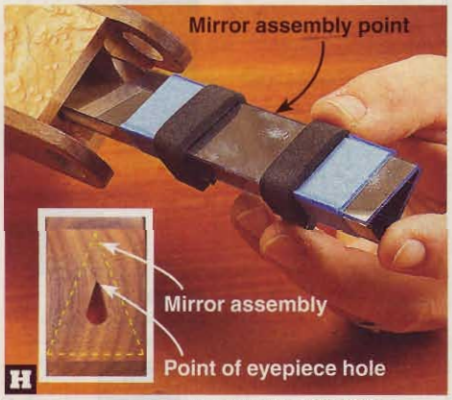


Place 4" pieces of masking tape, adhesive up, on the workbench. Center the narrow mirror and remove the protective film.

Flank the narrow mirror with the wide ones, leaving ⅛" gaps. Remove the film, and fold the mirrors into a triangle.

Cut three 4" pieces of foam tape from the kaleidoscope kit, and wrap them around the assembled mirrors. Trim the excess.





Slide the mirror assembly into the tube. Align the point of the mirror assembly with the point of the eyepiece hole.

Materials List

Kaleidoscope		FINISHED SIZE T	W	L	Matl.	Qty.
A*	body	1¼"	1⅝"	8⅛"	LBM	1
B*	eyepiece	⅜"	1¼"	1⅝"	W	1
C	wand brackets	¼"	1¼"	9⅜"	W	2
Stand						
D*	core blank	1½"	4¾"	7⅝"	LM	1
E*	side blanks	¼"	5³⁄₁₆"	8⅝"	W	2
F*	cleat	⅜"	1½"	⅝"	W	1

*Parts initially cut oversize. See the instructions.

Materials key: LBM–laminated bird's-eye maple, W–walnut, LM–laminated maple.

Supplies: Spray adhesive, double-faced tape, masking tape, cotton gloves.

Blade and bits: Stack dado set, ⅝" Forstner bit, ¼" brad-point bit.

Written by **Jan Svec**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**

Then assemble the three mirror strips, and insert them into the kaleidoscope tube [**Photos E, F, G, H**]. Make sure the mirror surface initially covered with protective plastic film faces the inside of the triangle. ***Note:*** *For the best optics, kaleidoscopes use front-surface mirrors. (The reflective surface is on the front surface of the glass rather than the back, as with regular mirror.) To avoid leaving fingerprints when handling the mirror, wear cotton gloves.*

3 Slide the oil-filled wand into the wand bracket (C) holes. Then roll the O-rings onto the wand from the ends, centering the wand in the brackets. Place the kaleidoscope on the stand. Let the reflective shapes and colored glitter settle into the bottom end of the wand. Now pick up the kaleidoscope, rotate it 180°, peek through the eyepiece, and enjoy the free-falling light show.

Sources

Kaleidoscope kit. Oil-filled wand, front-surface mirror (3), O-rings (2), foam tape, kit no. 9192, $15.95 plus S&H. Wand only, red shown on *page 90*, blue, purple, and green also available, no. 9185, $5.95 ea. plus S&H, specify color. Glass Crafters, 800/422-4552, or go to glasscrafters.com.

Wood kit. Bird's-eye maple, maple, and walnut planed to thickness for the parts listed *above*. Kit no. W-173K, $25.95 ppd. for one kit, $105.95 ppd. for five kits. Heritage Building Specialties. Call 800/524-4184, or go to heritagewood.com.

how to prevent a nipping when ripping

The incident

About a month after reading the Editor's Angle article "Shop safety: never take it for granted" in issue 162 (April/May 2005), I, unfortunately, did. While making a top for a chicken feeder, I ripped a 1¾"-wide piece from a 1x4 and shut off the saw. Before the blade had stopped, I reached for the cutoff with my left hand, and my thumb struck the blade, cutting two-thirds of the way through.

Following 14 stitches to close the wound, surgery 12 days later to insert pins, and four weeks of therapy, thankfully my thumb healed. Now I take my time and always wait for the blade to stop before reaching for ***anything****.*

Andy Haystead, Brooklyn, MI

The woodworker

Andy farms, raising soybeans, corn, hay, produce, and animals. He began woodworking about 10 years ago, primarily making items for the farm.

The warning signs

Although aware of the risk of injury when removing cutoffs with the blade spinning, Andy formed a bad habit by doing this many times without incident. The action had become automatic and seemingly safe. Other factors: He did not have a blade guard in place, which could have prevented the injury; plus he was not using a pushboard, leaving his right hand dangerously close to the blade.

The lessons

What does Andy's accident tell us? Never get too comfortable with your tablesaw or other power tools. When you hear that inner voice urging caution, pay attention. Don't take a chance that you can get away with a dangerous procedure. To keep hands safely away from the saw blade, follow these pointers:

- Use a blade guard. Make sure it's securely in place and working properly.
- After completing a cut, shut off the saw. Let the blade stop. Then remove the cutoff.
- Avoid awkward operations and body positions where a slip could direct a hand into the blade.
- Never reach around or over the spinning blade.
- When ripping boards longer than 3', use a support stand at the rear of the saw for safe control of the offcuts.
- Depending on the rip width, use the appropriate method to safely hold and guide the workpiece, as shown *below*.

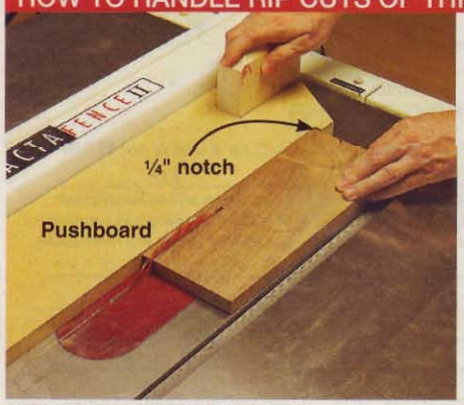
Note: *In the photos, the blade guard is removed for clarity only.*

Earn $100 for your story

Help other readers work safely by sharing a personal shop-related mishap or near miss. Send a detailed description of the incident (about 150 words) along with photos or illustrations and a daytime phone number, to Safety: Real-Life Lessons, WOOD Magazine, 1716 Locust St., LS-221, Des Moines, IA 50309-3023. Or e-mail us at safety@woodmagazine.com.

Opening illustration: **Melanie Powell**

HOW TO HANDLE RIP CUTS OF THREE VARIOUS WIDTH RANGES



RIP WIDTH LESS THAN 2": When the rip width is too narrow for the pushstick to clear the blade guard, use a shop-made pushboard to feed the workpiece.

RIP WIDTH BETWEEN 2" AND 6": Feed the workpiece through the blade using a pushstick in your right hand. Again, use your left hand as a guide.

RIP WIDTH GREATER THAN 6": Hold the workpiece tight against the fence, and feed it through the blade with your right hand. Use your left hand to guide the piece.

make a custom sanding block

Speed up finishing work on complicated moldings with an easy-to-make sander that's tailored to the job.

Sanding complex molding profiles holds the threat of becoming an endless chore when those curves and angles stymie your favorite power sanders. Smoothing each curved and flat portion of a profile separately with contoured sanding pads may do the job eventually; but there's a quicker alternative: custom-formed sanding blocks you make yourself.

We created this block using common automotive body filler. (Bondo is one well-known brand.) Fast-setting and less than $15 a gallon, body filler follows complicated shapes and cures to a hard surface. You'll also need these items:

- ¾" scrapwood about ¼" wider than the thickest portion of your molding.
- Two pieces of hardboard about 1' square.
- Spray-on cooking oil to keep the filler from sticking to the mold.
- Disposable gloves and a putty knife for mixing and applying the filler.
- Adhesive-backed sandpaper. Begin with 120 grit for stock molding and 80 grit for shop-made molding. Sand through at least 180 grit for most types of wood.

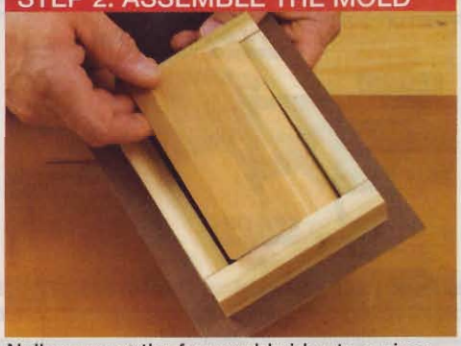
Safety note: *Filler produces heat as it hardens. Allow it to cure and cool before discarding unused portions.*

HOW TO CAST A PROFILED SANDING BLOCK

STEP 1: CUT THE MOLD PIECES

Cut a molding scrap as long as the width of your sandpaper. Then cut pieces of scrap-wood to form the sides of a mold box.

STEP 2: ASSEMBLE THE MOLD



Nail or screw the four mold sides to a piece of hardboard. Test-fit the molding sample in the box. It should be snug.

STEP 3: APPLY NONSTICK COAT

Spray a light coat of nonstick cooking oil on the sample and inside of the mold. Don't let it collect in the grooves of the molding.

STEP 4: MIX BODY FILLER

Following the manufacturer's directions, mix enough filler for the mold. Hardboard makes a solid but disposable mixing surface.

STEP 5: FILL MOLD

Filler begins to harden immediately, so work quickly. Press it firmly into the mold to fill crevices and corners.

STEP 6: PREPARE BLOCK FOR USE

Remove the block within an hour. Cut or sand away excess or irregularities. Small voids will not affect sanding quality.

STEP 7: ADD SANDPAPER

Wash off cooking oil and attach abrasives. Avoid folds that round off molding profiles. Now sand your molding, as shown at *top*.

our editors test

palm drivers

Why buy?

Sometimes a high-voltage cordless drill is just plain overkill for a small job—driving screws to install cabinet hardware, for example. That's when you'll find a palm-size driver mighty handy. It fits comfortably in a shop apron or tool belt, and gets into tight places no full-size drill can. In our tests, each of the three drivers shown here displayed surprising power. We drove 2" drywall screws into a pine 2×4 without pilot holes, and each driver exceeded our expectations. All three feature lithium-ion batteries that manufacturers say won't lose a charge even when stored unused for more than a year.

Black & Decker Li3000, $40

Editor test-drive:

At half the length and one-sixth the weight of my 14.4-volt drill/driver, Black & Decker's 3.6-volt Li3000 feels more like a hand tool than a power tool. On a full charge, the Li3000 drove 41 2" screws into unpiloted stock in about 10 minutes, although it did not fully seat most of them. After recharging the battery (a six-hour wait), I used the Li3000 for other shop tasks. I was able to drill 5/32" pilot holes into pine, but discovered the 1/4" hex chuck—which has a spring clip that presses against the bit's base—would not hold the bit to back it out, so I had to pull it out by hand. To my surprise, the Li3000 drove 62 #8×1" screws into pilot holes in pine before the battery gave out.

The single-speed, 180-rpm driver has a large handle trigger that I could grip comfortably with three or four fingers. But the three-position drive-direction switch atop the driver felt awkward to operate while gripping the tool. (The middle position locks the driver so you can use it as a screwdriver.) The tool includes a set of 40 hex drive bits.

—Tested by Owen Duvall, Projects Editor

To learn more:

800/544-6986; blackanddecker.com

Skil iXO, $40

Editor test-drive:

Skil's 3.6-volt iXO has enough oomph to drive just about any-size screw into a predrilled pilot hole in hardwoods. That said, it won't replace my 12-volt drill/driver for jobs that call for more torque or speed. The iXO drove 41 screws in the 2×4 test—although it could not fully seat them—taking about 11 minutes to drain the battery and three hours to recharge it. Even after this tough, continuous-duty test, the tool and its built-in battery felt only warm. I drilled a 1/16" hole into red oak, but the magnetic 1/4" hex chuck wasn't strong enough to back the bit out of the wood without slipping out of the tool. But its 200-fixed-rpm motor isn't meant for drilling; it's too slow.

The three-position drive-direction switch is located just above the trigger, as in larger drivers, and I like the LED arrows on top of the tool that show drive direction. The iXO comes with 32 driver bits, a 1/16" drill bit, and 1½" extension. In sum, it's a handy small-task tool that's always at the ready.

—Tested by Dave Campbell, Editorial Manager

To learn more:

877/754-5999; skil.com

Bosch PS-20 Pocket Driver, $130

Editor test-drive:

Comparing the Bosch PS-20 to the other compact drivers is like pitting a Porsche against a Yugo: Both perform the same functions, but on completely different levels. The PS-20 differs from the other two drivers because it has two removable 10.8-volt battery packs (so you always have a spare), double the torque, an 11-setting clutch, a quick-connect hex chuck, and a trigger-activated light. It is really just a baby cordless drill/driver. It comes with two hex drive bits (Phillips and flat) and a 30-minute charger.

I tested the tool by drilling with 1/8" and 1/4" twist bits into pine and ash and had no trouble. Next, I used 1/2", 3/4", and 1" spade bits to drill into hard maple. Although the variable-speed 400-rpm motor was slower than my 14.4.-volt drill/driver, it managed nicely. After recharging the battery, I drove 138 2" screws into a 2×4. Next, I used the PS-20 to drive 112 3" screws on a full charge. Very impressive for its size.

—Tested by Bob Hunter, Techniques Editor

To learn more:

877/267-2499; boschtools.com

rebuild miscut mortise & tenon joints in a snap

Don't throw that workpiece into the scrap bin just because you errantly cut the mortise or tenon. Instead, fix the problem. Here's how.

Mistakes will happen in the workshop, but that doesn't mean you have to start over. Because most mortise-and-tenon joints are invisible, you can bury your mistake—and its cure—without sacrificing appearance. Most errors in cutting mortises and tenons happen when a tenon is machined too small for its mortise, resulting in a loose fit. Cutting test pieces will, in most cases, head off these mistakes.

Your first and best choice: Repair the tenon

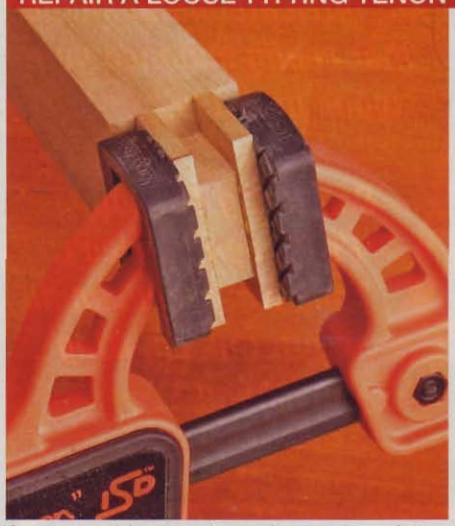
In a mortise-and-tenon joint the tenon should fit snugly into the mortise. We recommend cutting mortises first, and then making the tenon to fit. It's easier to add a patch to the cheeks of a tenon than to the walls of a mortise.

Now let's say that despite your best intentions you've cut your tenon too thin by 1/32" or 1/4". You'll get the best repair by first rebuilding the tenon's cheeks and then remachining them. To do this, first smooth the cheeks with a square-edged sanding block to prepare the tenon for gluing. Next, using a scrap of the same wood as your tenon, cut two "patches" at least 1/4" thick and slightly wider than the dimensions of the tenon but not wider than the rail. Glue and clamp the patches to the tenon, as shown *below left*. Now, after the glue dries, recut the tenon to fit the mortise, as shown *below center*.

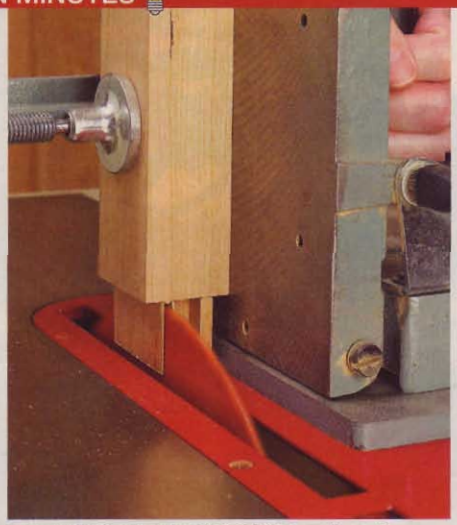
Although some woodworkers thicken tenons by gluing on veneer, we prefer solid wood patches because they're easier to clamp and machine, and they eliminate the guesswork of how much thickness to apply.

One word of caution though: If your mistake has reduced the thickness of the tenon by more than one-quarter, start over with a new workpiece. The tenon will have lost too much of its core strength for you to simply patch it.

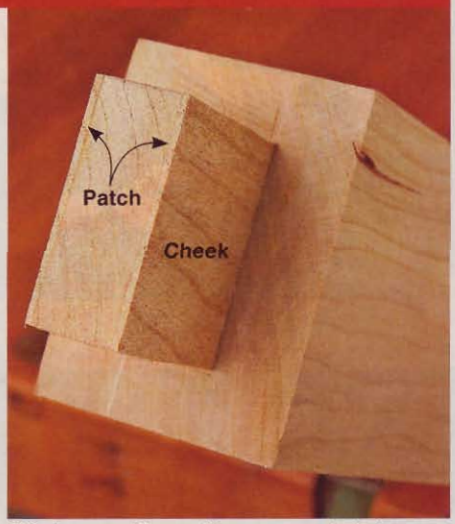
REPAIR A LOOSE-FITTING TENON IN MINUTES



Sand one side of each patch, and then glue and clamp it to the tenon. Make sure the patch's grain orientation matches the tenon's.



Recut the tenon by "sneaking up" on the final thickness, testing its fit in the mortise after each adjustment.



This tenon will now fit more snugly in its mortise because the cheeks have been built up with matching stock and remachined.

Your less-desirable choice: Repair the mortise

It won't happen often, but you might cut a mortise too long and expose some of it, especially with unshouldered tenons, as shown, at *right*. If the mistake will be visible on your project, you have three options: Enlarge the tenoned workpiece to cover the mortise, create a new mortised workpiece, or plug the mortise and recut it. The following are circumstances where you might prefer to plug the mortise:

- When you've taken great care to grain-match boards;
- When you're using expensive or exotic wood, and starting over would prove costly;
- When creating a replacement workpiece would be difficult or time-consuming (a bed post or turned table leg, for example).

To repair a mortise, start by cleaning the mortise walls with a sharp chisel to create a flat bonding surface. Next, cut a plug from a matching board, as shown *below, left*. Sand until it fits snugly, but don't push it all the way into the mortise until you're ready for glue. After plugging, recut the mortise.

YOU CAN FIX THIS

The mortise in this stile was cut too long for the rail to cover it. You can fill this mistake if it will be hidden on your project.

PLUG A TOO-LARGE MORTISE WITH MATCHING STOCK

Cut a plug from a test piece or scrap, orienting the grain to match the mortised workpiece; then sand it smooth.

Apply glue to the mortise walls with a glue brush, and then put a thin coat on the plug. Tap it into place with a mallet.

Leave the plug slightly proud of the workpiece; then sand it smooth once the glue has dried.

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Ridgid router kit: a mixed bag

One of my first routers was a Black & Decker with a built-in work light that illuminated the bit area. I loved that light, but when it burned out, I never replaced it. Later, as I stepped up to bigger and better routers, I forgot about the little light until I tried out Ridgid's R2930 fixed- and plunge-base router kit: It has a light. Actually, it has two bright white LEDs that won't burn out even after thousands of hours of use. The R2930's clear subbase further maximizes the view of the work area, which my 54-year-old eyes truly appreciate.

But you don't buy a router for a light—you buy it to machine wood, and the R2930 kit performs as well as any midsize router I've used, with ample power. One big plus: The variable-speed control shows the bit speed in rpms instead of the unintuitive 1–5 or A–F scales found on most variable-speed routers.

And like the latest generation of multi-base kits, the R2930's fixed base has through-the-base bit-height adjustments. That means you won't have to buy a router lift to adjust bit height from above your router tabletop. (Good thing, too, because its 3 19/32" motor diameter is larger than the 3½" motors commonly accommodated by lifts.) Unfortunately, I couldn't raise the router high enough to change bits from above the table unless I reached underneath to push the collet-locking button.

The action on the plunge base felt stiffer than I like, and you have to manually lock the cutting depth. (I prefer a spring-loaded plunge lock that locks on release). I also found switching bases a little awkward because the spring-loaded collet lock must be depressed before the base will come off or go on the motor.

Each base comes with its own dust-collection hood. (Although, oddly, the ports are different sizes: 1½" OD on the plunge base and 1 7/16" on the fixed base.) When connected to my vac (I wrapped tape to fit the odd-size port), both hoods proved 100 percent effective on captured cuts, such as flutes and dadoes, and about 80 percent effective when routing edges.

—Tested by Pat Lowry

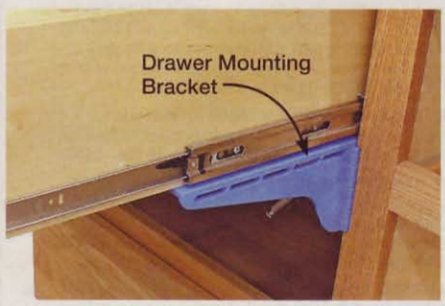
Ridgid R2930 router kit

Performance	★★★☆☆
Price	$200

Ridgid
800/474-3443; ridgid.com

Install ball-bearing drawer slides quick and square

If you've ever mounted ball-bearing drawer slides in a cabinet, you know how they make drawers glide like grease on glass. You also know how cumbersome they can be to align and install. Kreg's Universal Drawer Slide Mounting Tool makes mounting the cabinet side of the glide easy; the complementary Drawer Mounting Brackets do the same for the drawer side.



I used both accessories to install drawers in some built-in face-frame cabinets on each side of a fireplace, but they also work well with frameless cabinets. First, I stuck the drawer slide to the Drawer Slide Mounting Tool. An integral magnet holds the slide firmly; a flange on the bottom edge of the tool keeps it properly aligned on either the left or right side. Then, I simply clamped the tool to my face frame, resting it as shown *above, near right*, and ensured the glide was perpendicular to the face frame. To complete the installation, I simply secured the slide in place with screws, and then repeated the process for the other side.

Now, for the drawer. I clamped one Drawer Mounting Bracket under each slide, as shown *above, right*, and set the drawer box onto the brackets. After extending the slide to touch the back of the drawer front, I screwed the slide to the drawer box. The whole process took me about half the time normally required, and with a whole lot less frustration.

You can use one accessory without the other. But the cost for both is reasonable, even if you only do a few drawers a year.

—Tested by Pat Lowry

Universal Drawer Slide Mounting Tool and Drawer Mounting Brackets

Performance	★★★★★
Price	$30, slide mounting tool; $10, drawer mounting brackets

Kreg Tool Company
800/447-8638; kregtool.com

continued on page 108

The Ultimate Dust Collectors!

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2 & 3hp Dust Gorillas

Editor's Pick

American Woodworker - Jan. 2006

"Very simply, they are fabulous machines at excellent prices."

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Patent Pending Internal Silencer

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Patent Pending

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- Fine Woodworking / Oct. 06

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Lightweight clamps hold fast

I've used a lot of Jorgensen clamps in my shop, so I was glad to see the company introduce a new line of one-handed clamps, called ISD Bar Clamps. The soft, molded surfaces on the pistol-grip handle and trigger feel more comfortable in my hand than the hard plastic surfaces of my other one-handed bar clamps.

I'm all for comfort, but how well do they do their job? To find out, I sandwiched my bathroom scale between two pieces of oak and squeezed it as hard as I could, first with a competitor's clamp and then with the ISD Bar Clamp. The ISD hit the 200-lb mark; the competitor did 140 lbs. I did find the 3/16" of travel per squeeze of the trigger to be a bit slower than typical, though.

Equally impressive are the ISD hand clamps, sold under the "Pony" brand name. Like other clamps of this style, you can control the amount of clamping pressure you apply. But, instead of the click-click-click steps of most such clamps, the ISD Hand Clamp uses a clutch that lets you stop anywhere for complete control over clamping pressure. I also like the Pony's pressure release lever, which doesn't lurch when triggered.

—Tested by Charlie Bartlett

ISD Clamps

Performance ★★★★★

Price $13–$30, Jorgensen Bar Clamp, 6"–36"; $2–$7, Pony Hand Clamp, 1½–4"

Adjustable Clamp Company
312/666-0640; adjustableclamp.com

continued on page 110

EZ-Mount hinge-plate jig helps install Euro hinges with little effort

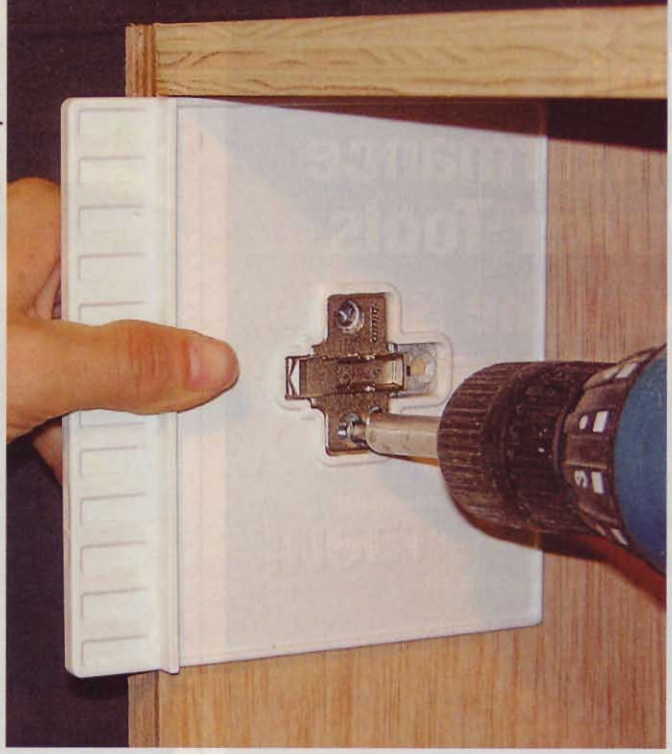
I've always liked European-style cabinet hinges because they're adjustable, so I can fine-tune the door alignment after installation. Plus, it's easy and accurate to drill the 35mm pockets into the doors using a drill press. But mounting the hinge plates precisely on the cabinet has always been the real trick to using these hinges. That's where EZ-Mount comes to the rescue.

To use EZ-Mount, simply snap a hinge plate into the appro-priate jig (there's one for inset doors and another for overlay doors). Hold the jig with its fence against the front cabinet edge, as shown at *right*, and its top edge against the cabinet top. That positions the plate exactly 37mm from the edge and 3" from the top. Now, using a self-centering drill bit in the hinge-plate holes, drill pilot holes, drive the mounting screws, and pop off the jig. Repeat the process at the bottom of the cabinet, and you're done. It literally takes seconds to mount both hinge plates.

For locating a hinge anywhere other than 3" from the top or bottom, EZ-Mount's molded centerline ensures precise positioning. On melamine-coated particleboard, though, I found that the jig tended to slip and slide because of the plastic-on-plastic contact. But I remedied that concern by applying four self-adhesive bumpers to one face.

EZ-Mount works only with Euro-style hinges made by Blum and Salice. Check the manufacturer's Web site for the specific hinges it fits, and the EZ-Mount model number for your hinge.

—Tested by Jan Svec



EZ-Mount

Performance	★★★★☆
Price	$20

EZ-Mount Hardware Mounting Systems
480/829-1214; ez-mount.com

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what's ahead

A sneak peek inside the December/January issue (on sale November 21)

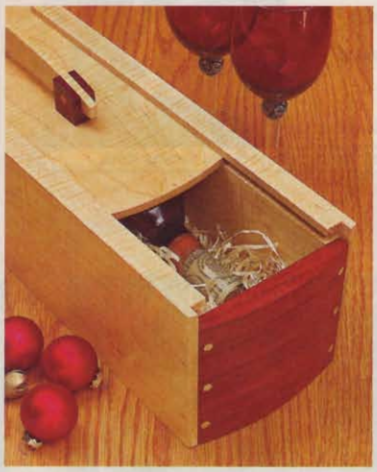
Home enhancers and holiday gifts

Classic corner cabinet

Show off your collectibles in this beautiful heirloom. Easy-to-install, low-temperature xenon lights cast a glow on treasured objects.

Bracket clock

Straightforward rabbet joinery and full-size patterns make this time-honored project a snap to make.



Wine gift box

Show your holiday spirit in this quick-to-make, presentation-quality container. It'll be appreciated long after the wine disappears.

Child's dresser/ changing table

Like the 3-in-1 transition bed on *page 44*, this project stays with a child from infancy through the teen years.

Tool news you can use

Hot new tools for 2007

Our intrepid tool editors have done it again: they've uncovered the coming year's most innovative and handy tools.

How to install crown molding

Follow these simple tricks to cut and install gap-free, perfectly aligned crown molding atop projects like the corner cabinet.

Eking precision from portable power tools

Is it possible to get dead-on, super-clean cuts using your portable circular saw, jigsaw, and handheld drill? We say "yes," and we'll show you how.

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WOOD® Magazine's Guide to Clamping

One of the keys to successful woodworking is smart gluing and assembly of materials. Of course, you have to have clamps in your shop to assemble parts correctly. And you must understand how to use the clamps you own. Here are our best tips for successful gluing.

■ **First, dry-assemble**. Before applying a drop of glue to any surface, dry-asssemble and clamp your workpieces. This way, you'll know whether the pieces fit and whether you have enough clamps to get the job done properly. For edge-to-edge glue-ups, figure about 10" spacing between clamps. For larger projects, break down the gluing process into smaller subassemblies for working ease.

■ **Do not overclamp.** No amount of clamping pressure has ever turned a bad joint into a good joint. Re-machine ill-fitting parts rather than force them into alignment with clamps.

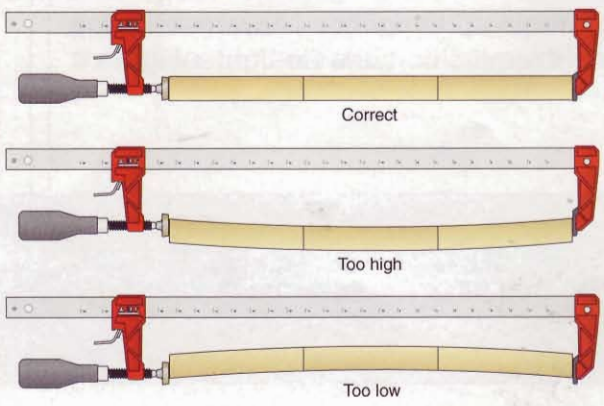
■ **Spread out clamp pressure.** Some clamp styles exert pressure in a small area. Place auxiliary blocks of wood between the clamps and workpiece to spread out the pressure evenly.

■ **Spread glue evenly.** You'll get great results by spreading glue on just one of the mating surfaces; covering both pieces doubles the risk of excessive squeeze-out. When possible, wiggle or twist one part to ensure a reliable transfer of glue to both pieces.

■ **Protect the workpiece.** If you're not careful, clamps will dent or stain your project's surface. Make sure the jaws of your clamps are free of grease, dirt, clumps of dried glue, and other debris. To be on the safe side, place wooden pads over the jaws of the clamp. To prevent glue from reacting with a metal clamp surface and staining the wood, lay a protective sheet of waxed paper between the clamp and the workpiece.

■ **Properly position clamps in the line of pull.** Whenever you clamp edge-joined boards, make sure the clamp screw and opposing jaw line up with the center of the joined boards. If you position the clamp a little high or low, bowing likely will result.

ALIGN CLAMP JAWS PROPERLY



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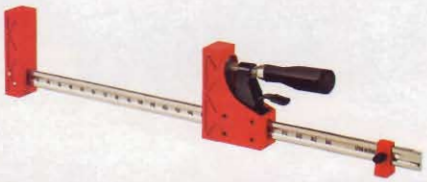
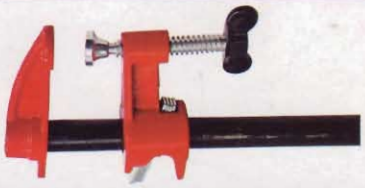
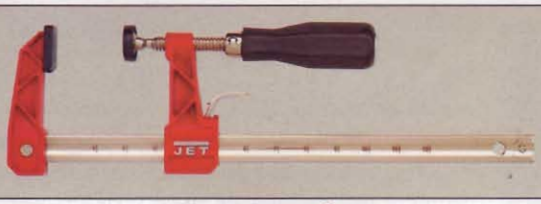
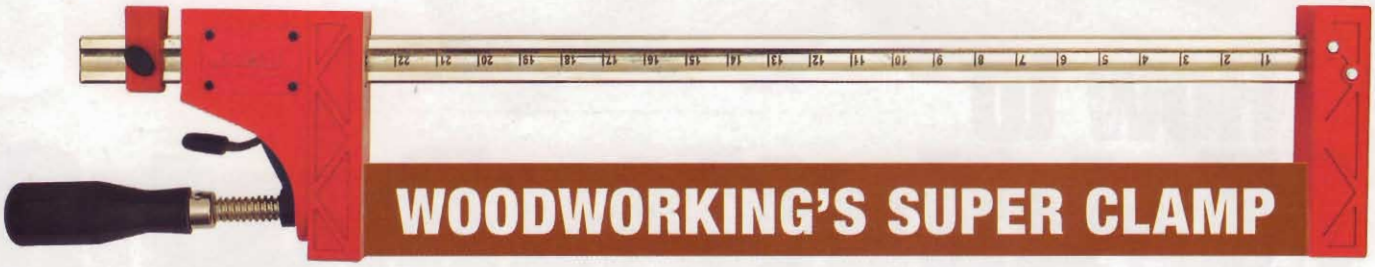
JET®

How to Match the Best Cl

CLAMP		PROS
Parallel Clamp		■ Self-supporting on benchtop ■ Parallel jaws prevent bowing during glue-up ■ Oversized jaws distribute clamping pressure ■ Glue-resistant resin jaw faces ■ Reversible for spreading capability
Aluminum Bar Clamp		■ About 50% lighter than pipe clamps (comparing 48" models) ■ Easy to maneuver ■ Reversible for spreading capability
Pipe Clamp		■ Reversible for spreading capability ■ Inexpensive to lengthen ■ Works with stock of any length ■ Ample clamping pressure
F-Style Bar Clamp		■ Quick-release lever allows fast two-handed adjustments at any point along the bar ■ Protective caps reduce marring ■ Ample clamping pressure
One-Hand Clamp		■ Hold workpiece with one hand while tightening clamp with the other ■ Movable jaw closes quickly ■ Jaw release trigger relaxes pressure ■ Lightweight
Handscrew Clamp		■ Wide, independent jaws with deep reach ■ Ability to clamp nonparallel surfaces ■ Can spread pressure over entire surface ■ During machining, wood jaws ideal for holding parts (no damage to blades or bits)
Web Band Clamp		■ Provides even wraparound pressure ■ Ideal for projects with multiple sides
Spring Clamp		■ Inexpensive ■ Instant positioning to prepare for other clamps or fasteners ■ Ideal for small assemblies ■ Lightweight

lamp to the Task

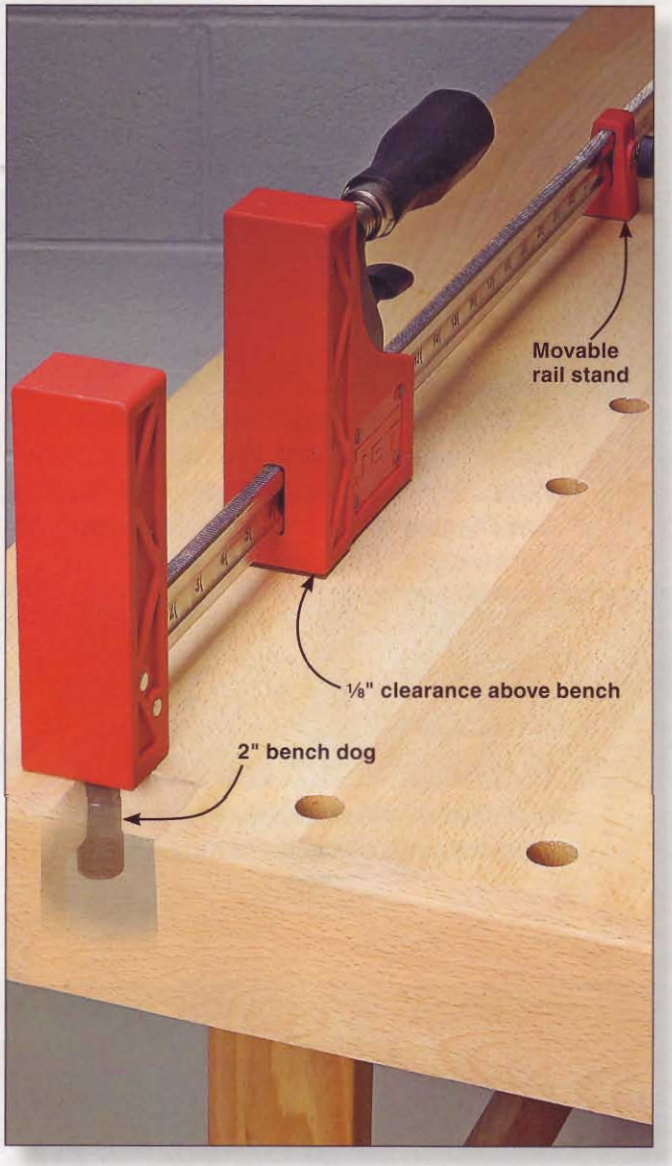
CONS	BEST USE
■ Investment required for a complete set ■ Heavy ■ Not designed for small projects	**Far left:** Square assembly requiring clamping pressure in four directions. **Left:** Side of head clamps narrow stock.
■ Under heavy clamping pressure, bars flex ■ More expensive than pipe clamps ■ Not designed for small projects	**Far left:** Assembly of rails and stiles. **Left:** Large carcase requiring multiple clamps.
■ Heavier than aluminum clamps ■ Glue moisture contacting steel pipe may stain project. To prevent, lay a protective sheet of waxed paper between the metal bars and the workpiece.	**Far left:** Clamping long assemblies. **Left:** Applying ample pressure across wide expanses.
■ Small pressure point can mar wood ■ Challenging to work one-handed	**Far left:** Clamping face frame to carcase. **Left:** Applying ample pressure to narrow assemblies.
■ Under pressure, bar can flex ■ Expensive ■ Difficult to apply beyond about 150 lbs of clamping pressure	**Far left:** One hand is free to hold assembly while other hand operates clamp. **Left:** Having one hand free eases assembly of large projects using these light clamps.
■ Requires adjusting two handles to reach the proper width ■ Expensive	**Far left:** Keeping hands away from router bit. **Middle:** Clamping and machining small pieces. **Left:** Clamping stopblock at tablesaw.
■ Effort required to tighten. Newer ratcheting models require no tools for tightening.	**Far left:** Clamping irregular shapes. **Left and above:** Clamping mitered assemblies.
■ Requires strong grip to open ■ Glued surfaces may slip ■ All the clamping pressure confined to a small area	**Far left:** Temporary positioning of glued stock before screwing together assembly. **Left:** Clamping small pieces.

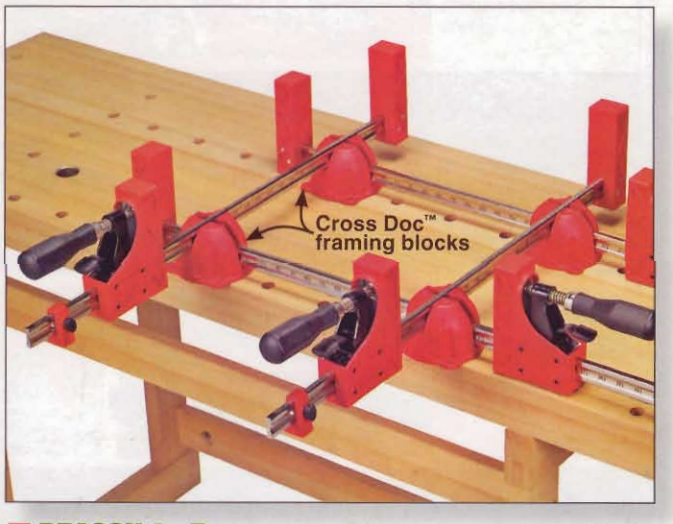


WOODWORKING'S SUPER CLAMP

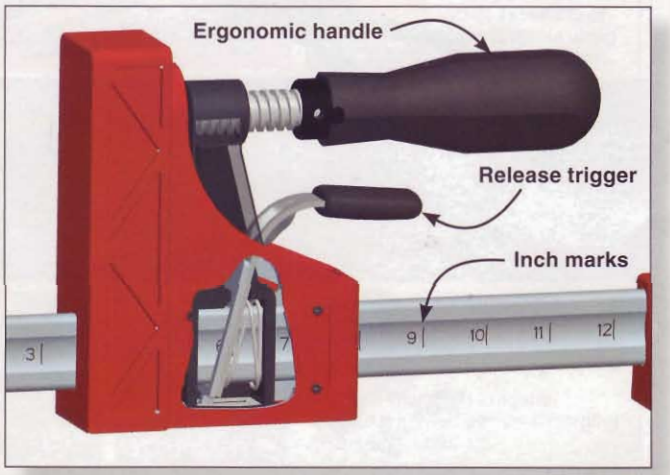
3 reasons parallel clamps belong in every shop

REASON 1: Wide jaw faces align at 90°. Parallel clamps feature wide, non-marring faces that remain parallel, virtually eliminating bowing or "lifting" during glue-ups. The beefy 1 3/16×4 1/8" jaws on the Jet clamps, shown *below*, distribute clamping pressure over a wider area than any bar or pipe clamps. Here's one more feature you won't want to overlook: On your workbench, the clamp rests on the fixed jaw and movable rail stand, allowing 1/8" of clearance for the sliding jaw.





REASON 2: Easy assembly. When coupled with the accessories shown *above*, this system really shines. The framing blocks allow woodworkers to clamp up an assembly from four directions. Accessory 2" bench dogs (see photo at *left*) keep the clamp in place while you focus your attention on the assembly task. Need a lot of clamp pressure? Jet rates the capability for its parallel clamps at 1,000 pounds per square inch.



REASON 3: Precision adjustments. The inch marks stamped on the bar allow you to quickly preset your clamps. The patented quick-release trigger means you'll spend less time adjusting the clamps. And as you tighten the assembly, the ergonomic handle is kind to your hands.